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In this issue:

A Review of the Air Force Materials Research and Development Program

A Bibliography on Gas Lubricated Bearings—Revised

Technical Resources Directory: Missile Ground Support Equipment

Heat Capacity of Beryllium

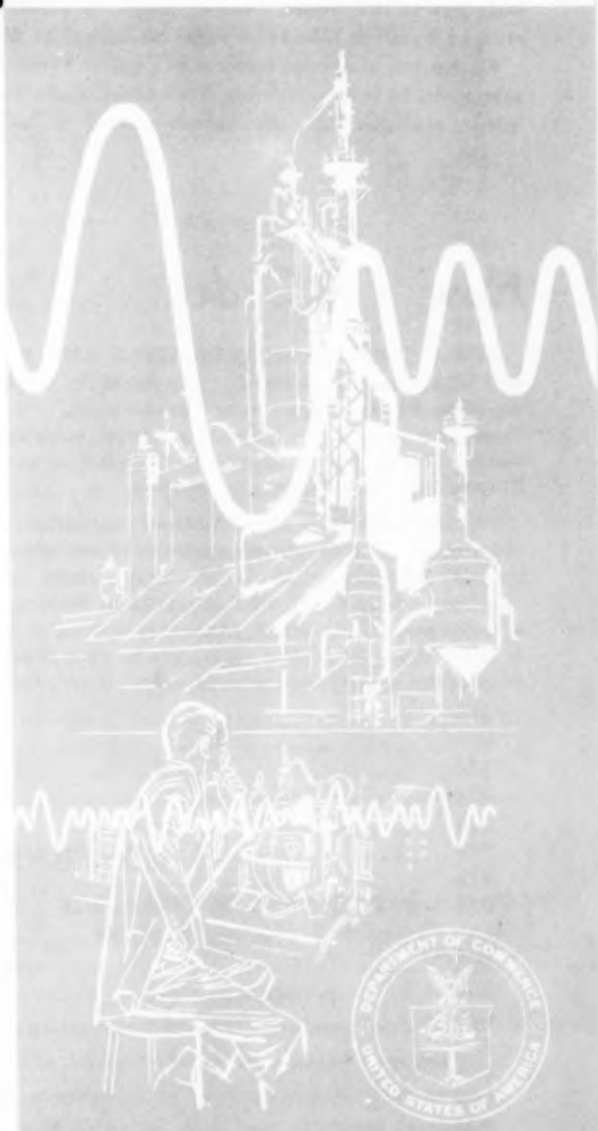
Toxicity of Beryllium

Development and Evaluation of an Improved Field Radio Repair Course

A Feasibility Study of the Application of Mass Spectrometry to Paint Vehicle Analysis

Analysis Design Study of a High Capacity Lightweight Compressor

Complete list of printed reports begins on page 349



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CONTENTS

	Page
BIBLIOGRAPHY	353
ASTRONOMY	353
Astrophysics	353
BEHAVIORAL SCIENCES	354
Psychology	356
BIOLOGICAL SCIENCES	358
Anatomy and Physiology	358
Biochemistry	359
Botany	359
Medical Specialities and Equipment	360
Pharmacology and Toxicology	360
Radiobiology	361
CHEMISTRY	361
Organic Chemistry	362
Physical Chemistry	362
EARTH SCIENCES	365
Climatology and Meteorology	366
Geodesy	368
Oceanography	369
Physics of the Atmosphere	369
ENGINEERING	370
Aeronautical Engineering	370
Chemical Engineering	374
Civil Engineering	374
Electrical and Electronic Engineering	374
Mechanical Engineering	
Ordnance, Missiles, and Satellite Vehicles	388
Sanitation and Safety Engineering	396
Ship Building	396
MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT	397
Engines and Propulsion Systems	397
Machine Parts and Mechanisms	399
Manufacturing Equipment and Processes	399
MATERIALS	399
Ceramics and Refractories	400
Fuels, Lubricants, and Hydraulic Fluids	401
Leather and Textiles	402
Plastics	403
Rubber and Elastomers	404
Wood and Paper	404
MATHEMATICS	404
Computing Devices	408
MECHANICS	410
Aerodynamics and Pneumatics	411
Hydrodynamics, Hydraulics, and Hydrostatics	415
METALLURGY	416
Ferrous Metals	417
Light Metals	419
Nonferrous (except light) Metals	419
Structural Metallurgy and Corrosion	419
NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY	422
Elementary Particles	422
Radioactivity	423
PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT	424
PHYSICS	424
Acoustics	424
Electricity and Magnetism	425
Electronics	426
Molecular Physics and Spectroscopy	426
Optics	428
Solid State Physics	429

Page

PHYSICS (con.)
Theoretical Physics 432
Thermodynamics 433
Wave Propagation 434
RESEARCH METHODS, TECHNIQUES AND EQUIPMENT 437
Photographic Equipment 437
SOCIAL SCIENCES 438
MISCELLANEOUS 438
ATOMIC ENERGY COMMISSION REPORTS 439
Biology and Medicine 439
CHEMISTRY 440
General 440
Radiation and Radiochemistry 441
Separation Processes for Plutonium and Uranium 441
CONTROLLED THERMONUCLEAR PROCESSES 442
CRITICALITY STUDIES 442
HEALTH AND SAFETY 442
INSTRUMENTS 442
METALLURGY AND CERAMICS 443
PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES 444
PHYSICS AND MATHEMATICS 444
SOURCE INDEX I-1
SUBJECT INDEX I-11
NUMBER INDEX I-27

Printed Reports Available From OTS Announced in This Issue

Page

BIBLIOGRAPHY

Searching the literature for transducer information. Part I. A guide to the literature. Oct 59. 61p. (PB 161 320) $1.75 353

BEHAVIORAL SCIENCES

Decision-making studies. Part I. The trade-off of variables in decision making. Jan 60. 9p. (PB 161 052) 50 cents 357
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Studies in research methodology. I. Compatibility of psychological measurements with parametric assumptions. Sep 59. 26p. (PB 161 335) 75 cents 356

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EARTH SCIENCES

A preliminary report on a boundary layer numerical experiment. Oct 59. 36p. (PB 161 341) $1.00 369
Refinements in utilization of contour charts for climatically specified wind profiles. Oct 59. 28p. (PB 161 346) 75 cents 366
Scientific studies at Fletcher's Ice Island. Sep 59. 229p. (PB 161 289) $3.50 369
Study of a pulsed logarithmic photometer. Sep 59. 29p. (PB 161 344) 75 cents 368
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ENGINEERING

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ENGINEERING (con.)

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Installations--General. Insect and rodent control. Feb 56. 176p. (PB 161 357) $3.00 396
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Preliminary studies of brittle fracture propagation in structural steel. May 58. 91p. (PB 161 325) $2.25 397
Recalibration procedure for oxygen regulator test stand calibrator (National Instrument Laboratory Calibrator) Aug 59. 17p. (PB 161 334) 50 cents 370
Review of the Air Force materials research and development program. Nov 59. 169p. (PB 111 648 sup. 5) $3.00 372
Technical resources directory: Missile ground support equipment. Nov 59. 22p. (PB 161 103) 50 cents 390
Titanium fabrication and reliability problems in aircraft. Sep 59. 32p. (PB 161 183) 50 cents 371
Weld flaw evaluation. July 58. 122p. (PB 161 322) $2.75 403

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

A bibliography on gas lubricated bearings-revised. Sep 59. 109p. (PB 161 017) $2.50 399
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MATERIALS

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MATHEMATICS

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MECHANICS

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On the stability of one-dimensional viscous flows: Sound waves and shock waves. Aug 59. 53p. (PB 161 318) $1.50 411

Page

METALLURGY

380 A brief review of refractory metals. Dec 59. 37p. (PB 161 190) 50 cents ... 419
372 Development of a corrosion-resistant bearing steel for service in aircraft at temperatures up to 1000F. Oct 59. 70p. (PB 161 338) $1.75 ... 420
375 Development of high-strength steels by working of metastable austenite. Nov 59. 24p. (PB 161 189) 50 cents ... 417
396 Development of high-temperature iron-base alloys. Oct 59. 71p. (PB 161 337) $2.00 ... 417
396 Drilling high-strength steels heat treated to 330 to 560 Brinell hardness. Aug 59. 17p. (PB 161 181) 50 cents ... 418
397 Electron bombardment melting and casting of beryllium. Nov 58. 44p. (PB 161 327) $1.25 ... 417
396 Emulsifiable and fire resistant rust preventives. Apr 59. 73p. (PB 161 352) $2.00 ... 421
Fabrication of pure columbium. Sep 59. 9p. (PB 161 184) 50 cents ... 419
Heat capacity of beryllium. Oct 59. 11p. (PB 161 186) 50 cents ... 419
388 Heat treatment of high-strength steels for airframe applications. Nov 59. 111p. (PB 151 076) $2.50 ... 418
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390

MISCELLANEOUS

371
403 Report of NRL Progress. Feb 60. (PB 161 278) $1.25, $10.00/year ... 438

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Global fallout and its variability. Oct 59. 37p. (PB 161 345) $1.00 ... 423
399

PHYSICS

399
Atmospheric refraction of infrared radiation. Oct 59. 20p. (PB 161 342) 50 cents ... 420
Bibliography on acoustic sources and their related fields. Feb 59. 69p. (PB 161 330) $1.75 ... 425
400 Bibliography on propagation of sound through plates. Feb 59. 170p.
402 (PB 161 329) $3.00 ... 425
Communication theory aspects of television bandwidth conservation.
403 Aug 59. 27p. (PB 151 384) 50 cents ... 435
Design of single frequency filters. Aug 59. 10p. (PB 151 382) 50 cents ... 436
403 Determination of near infrared spectra. Sep 59. 32p. (PB 161 336) $1.00 ... 428
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Radio noise data for the International Geophysical Year July 1, 1957-December 31, 1958. July 59. 239p. (PB 151 377) $2.50 ... 436
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411 Service area of an airborne television station. Oct 59. 46p. (PB 151 394) 75 cents ... 437
411 Study of a phosphor light pulser. Sep 59. 26p. (PB 161 343) 75 cents ... 428
411 Survey of Central Radio Propagation Laboratory research in tropospheric propagation. Sep 59. 464p. (PB 151 385) $4.00 ... 436

Tables of thermodynamic properties of air including dissociation and ionization from 1500°K. Dec 59. 147p. (PB 161 311) $2.75..... 433
Temperature conversion tables. Nov 59. 85p. (PB 161 354) $2.25..... 424

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Vol. 33, No. 4 Pp. 349-444 April 15, 1960

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Diamond Ordnance Fuze Labs., Washington, D. C.
SEARCHING THE LITERATURE FOR TRANSDUCER INFORMATION. PART 1. A GUIDE TO THE LITERATURE, by J. Pearlstein. 15 Oct 59, 61p. TR-753.
Order from OTS $1.75 PB 161 320

This report provides a guide to the technical literature on transducers, including a classification of the related phenomena, principles, and materials which must be considered in any broad and systematic research and development program on these devices.

Patent Office, Washington, D. C.
PATENT CLASSIFICATION MICROFILM. [1960]
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Reel no. 2, Patent Classes 61-120
Reel no. 3, Patent Classes 121-180
Reel no. 4, Patent Classes 181-249
Reel no. 5, Patent Classes 250-346 /
Cross Reference Classification
Reel no. 6, Patent Classes 1-70
Reel no. 7, Patent Classes 71-140
Reel no. 8, Patent Classes 141-210
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Patent Office, Washington, D. C.
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The complete record of the classification of design patents is contained in a single microfilm reel (16 mm) which includes both the original and cross reference classification of these patents. (See also PB 144 504)

ASTRONOMY

Astrophysics

Arizona State Coll., Flagstaff.
GRATING RESOLUTION AT 6.3 MICRONS IN THE SOLAR-TELLURIC SPECTRUM, by Arthur Adel. Scientific rept. HB-7 on Infrared Spectroscopy of the Sun, Moon and Earth, Contract AF 19(604)2177. 10 Aug 59, 37p. AFCRC-TN-59-465.
Order from LC mi$3.00, ph$6.30 PB 144 583

The ephemeral atmospheric window at 6.3 microns has been observed with grating resolution. Twenty-five spectra of the region 6.150 mu - 6.350 mu are reproduced. (Author)

Carter Observatory (New Zealand).
OBSERVATIONS OF THE AURORA AUSTRALIS 1955 AND 1956, by G. W. McQuistan and B. L. Frankpitt. Scientific rept. no. 6 on Contract AF 64(500)04. 1 Mar 57, 42p. AFCRC TN-58-215; AD-146 866.
Order from LC mi$3.30, ph$7.80 PB 138 236

Visual observations of the Aurora Australis collected in New Zealand and adjoining regions over the period 1955 and 1956 are here recorded in a form suitable for further researches. (See also PB 138 689)

Geophysical Inst., U. of Alaska, College.
PHOTOMETRIC STUDIES OF AURORAL LUMINOSITY AND ITS CONNECTION WITH SOME ATMOSPHERE IONIZATION PHENOMENA, by W. B. Murcray. Scientific rept. no. 2 on Contract AF 19(604)1859. Sep 58, 20p. 12 refs. AFCRC-TN-58-386; AD-160 839.
Order from LC mi$2.40, ph$3.30 PB 137 890

The auroral radiation, 3914 Å, received from the entire sky on a horizontal diffusing plate was monitored continuously during the nights of 1955-56 and 1956-57. The 1955-56 data and part of the 1956-57 data were used to obtain a diurnal curve for the sky luminosity in this wavelength. The auroral light increases to a broad maximum which lasts from magnetic midnight till dawn. The luminosity was found to correlate fairly well with absorption as inferred from F-min values and with $(F\ E_S)^2$ and very well with the magnetic K indices.

High Altitude Observatory, Boulder, Colo.
FLARE-ASSOCIATED BURSTS AT 18 Mc/s, by C. Warwick and J. W. Warwick. Scientific rept. no. 3 on Contract AF 19(604)3872. 14 May 59, 13p. 10 refs. AFCRC-TN-59-364; AD-217 075.
Order from LC mi$2.40, ph$3.30 PB 144 430

Burst data are described resulting from continuous operation of an SCNA (sudden cosmic noise absorption) recorder since December, 1955. Bursts occur frequently in close time connection with flares but may appear before, during, or after the flare. On several occasions, these bursts can be directly identified as the low-frequency tail of type II bursts observed at higher frequencies. On less well-observed occasions, the low-frequency bursts do not appear to have higher frequency counterparts.

High Altitude Observatory, Boulder, Colo.
THE IONIZATION CROSS-SECTION OF FeXIV IN THE SOLAR CORONA BY ELECTRON COLLISION AND ITS RELATIONSHIP TO THE TEMPERATURE OF THE CORONA, by Sanford B. Schwartz. Doctoral thesis. Rept. on Contract Nonr-393(04). Jan 59, 81p. 33 refs.
Order from LC mi$4.80, ph$13.80 PB 144 455

The general problem of determining an estimate of the temperature of a quiet region of the solar corona is discussed.

Maryland U., College Park.
TRAPPED RADIATION IN THE EARTH'S MAGNETIC FIELD, by S. F. Singer. Scientific rept. no. 2 on Contracts AF 49(638)530 and AF 19(604)5575. Aug 59, 8p. 17 refs. Physics Dept. Technical rept. no. 153; AFCRC-TN-59-765; AFOSR-TN-59-1028.
Order from LC mi$1.80, ph$1.80 PB 144 416

The purpose of this paper is to look at a topic in astrophysics from the point of view of the laboratory. We will therefore not be concerned very much with the geophysical significance of trapped radiation. Rather, we want to examine what nature can tell us about the confinement of particles.

BEHAVIORAL SCIENCES

Personnel and Training

Adjutant General's Office, Washington, D. C.
DEVELOPMENT OF A PROVISIONAL BATTERY FOR SELECTING ARMY HELICOPTER PILOT TRAINEES, by Nathan Rosenberg, Harold Martinek, and Alan A. Anderson. June 59, 34p. 4 refs. PRB Technical research note 104; AD-226 801.
Order from LC mi$3.00, ph$6.30 PB 144 671

A six-test battery to predict pass versus fail in training at the U. S. Army Primary Helicopter School was derived from valid tests in each of 4 batteries administered to 4 samples of helicopter pilot trainees. The tests selected were administered to a fifth sample to obtain measures of their intercorrelation essential to application of a test selection procedure. Thus, validity coefficients based on different samples were used in conjunction with intercorrelation coefficients in yet another sample to derive a new battery. Granting the experimental weakness of this procedure, the estimated validity of the resulting battery was higher than that of either of the 2 batteries which have been in operational use. (Author)

Bucknell U., Lewisburg, Pa.
SELF-INSTRUCTIONAL DEVICES: A REVIEW OF CURRENT CONCEPTS, by William J. Carr. Rept. on Human Factors in the Design of Training Equipment, Contract AF 33(616)6526. Aug 59, 29p. 37 refs. WADC Technical rept. 59-503.
Order from OTS $0.75 PB 161 339

A selective review of the literature on self-instructional devices is presented, with emphasis on those studies which provide for a functional analysis of such devices. Three major classes of variables which influence the effectiveness of learning by means of self-instructional devices are: characteristics of the device, characteristics of the program, and characteristics of the learner. Major attention is devoted to an analysis of the process of programming, or the arrangement of the materials to be learned in proper sequence which maximizes rate of learning and degree of retention. Discussion is focussed on a number of variables of which the effectiveness of the process of programming might be a function. Some of these variables have not yet been subjected to experimental analysis. A working model is presented, based upon the familiar processes of conditioning. (Author)

Courtney and Co., Philadelphia, Pa.
EVALUATION OF A SHIPBOARD SUPERVISORY TRAINING PROGRAM FOR PETTY OFFICERS, by Myron A. Fischl and Douglas Courtney. Technical rept. on Contract Nonr-2212(00). 31 Dec 57, 82p. 13 refs. Rept. no. 19; AD-151 939.
Order from LC mi$4.80, ph$13.80 PB 137 993

A description is given of the measures of workability and the fleet tryout, and recommendations for imple-

mentation and additional research are made. The over-all conclusion is that the program efficiently and effectively increased knowledge of principles and practices in on-the-job training, and it elicited favorable attitudes from the trainees.

Human Resources Research Office, George Washington U., Washington, D. C.
DEVELOPMENT AND EVALUATION OF AN IMPROVED FIELD RADIO REPAIR COURSE, by George H. Brown, Wesley C. Zaynor and others. [Rept. on Contract DA 49-106-qm-1.] Sep 59, 89p. 5 refs. Technical rept. 58.
Order from OTS $2.25 PB 161 321

The objective of this study was to assist the U. S. Army Signal School in the development and experimental evaluation of an improved training course for Field Radio Repairmen, MOS 296.1. Graduates of the experimental course were significantly superior to the standard course graduates on four of the seven tests in the battery -- the Trouble Shooting, Test Equipment, Repair Skills, and Achievement tests. The groups did not differ significantly on the remaining tests -- the Alinement, Manuals, and Schematics tests.

Institute of Personality Assessment and Research, U. of California, Berkeley.
AN ASSESSMENT STUDY OF AIR FORCE OFFICERS. PART II: DESCRIPTION OF THE ASSESSED SAMPLE, by Harrison G. Gough and Irving Krauss. Rept. on Contract AF 18(600)8. Sep 58, 31p. 9 refs. WADC-TR-58-91, Pt. 2; AD-208 700.
Order from LC mi$3.00, ph$6.30 PB 144 605

An extensive psychological assessment of a group of Air Force captains is described. It presents sociological and psychological descriptions of the sample of 343 captains participating in the field-testing phase of the assessment. The typical member may be characterized as being a reserve officer who entered the service during World War II as an elisted man and who received his commission through flying school. He is eligible for promotion to the grade of major. He is married and desires an Air Force career. His intelligence score is above the mean for the general adult population, but below the level defined by Terman and others as superior. His personal adjustment and psychiatric stability are judged to be excellent. In social technique he is characterized by factors of leadership and dominance, capacity for status, and achievement motivation. Tests of social acuity and social insight place him in an average rank among groups of equivalent education or occupational status. His vocational interest profile is basically a military officer profile similar to the pattern observed in other studies of military officers. (Author) (See also PB 142 096)

Maryland U., College Park.
DEMOGRAPHIC VARIABLES IN THE PREDICTION OF RECRUITMENT, by Ray C. Hackman. Final rept. on Contract Nonr-2141(00). Oct 57, 39p. 3 refs. AD-146 702.
Order from LC mi$3.00, ph$6.30 PB 138 223

This study investigated the relationship between the United States Navy's 1955 recruiting rate and forty-three variables describing the demographic characteristics of 40 of the 43 cities designated as main recruiting stations for the Navy. Fifteen of these measures correlated significantly with recruiting rate. A set of five of these variables correlated .79 with the criterion. The general pattern of relationships suggests that recruitment is more effective in less densely populated and less highly industrialized cities.

Naval Ordnance Lab. [White Oak, Md.]
SOLID BLAST PROTECTIVE DEVICES FOR SHIPBOARD PERSONNEL, PRELIMINARY EVALUATION OF MATERIALS FOR, by F. R. Barnet. 29 July 47, 20p. 3 refs. Naval Ordnance Lab Memo. 9147.
Order from LC mi$2.40, ph$3.30 PB 145 084

During sea battle personnel are subject to high velocity shock waves traveling through the ship's structure due to explosions aboard the ship or in close proximity to it. The effects of this "Solid blast" or "Deck heave" are such that persons may suffer serious injuries such as broken or crushed bones in the ankle, leg or spine, or severe blows due to being thrown against bulkheads or projections. In carrying out research work on protective devices, materials such as plastic foams or cellular structures, collapsible metal rings and rubber mats and rubber shoe soles were investigated. The rubber mats and shoe soles appeared to be the most satisfactory in every respect of the experimental devices considered. (Author)

Naval Personnel Research Field Activity, Washington, D. C.
EVALUATION OF AN ADVANCED COURSE FOR FIRE CONTROL TECHNICIANS, by Norman M. Labbe and Kalmer E. Stordahl. June 59, 40p. 3 refs. BuPers Technical Bulletin 59-16.
Order from LC mi$3.00, ph$6.30 PB 144 536

In this study, two groups, a group taking the experimental course and a group taking the regular Class B training were compared after the training on their demonstration of the fundamental skills and knowledge required to maintain unfamiliar fire control equipments. It was found that the students in the experimental group exceeded the students in the regular Class B training only in the extent of their mastery of mathematics, but not in their mastery of other maintenance requirements for the unfamiliar fire control equipment.

Naval Personnel Research Field Activity, San Diego, Calif.
NAVAL KNOWLEDGE AS PREDICTOR OF CAREER MOTIVATION AND ACADEMIC PERFORMANCE IN THE NROTC PROGRAM, by Bernard Rimland. June 59, 34p. 10 refs. BuPers Technical Bulletin 59-12; AD-227 793
Order from LC mi$3.00, ph$6.30 PB 144 537

Correlations between NKT scores and first semester grade point average were found to be about .10 for both Contract (N=2562) and Regular (N=1433) students.

NKT did not contribute to the multiple correlation of other tests with first semester grades. Correlations between NKT scores and first semester Naval Science Grades were found to be about .40 for Contract students and about .30 for Regulars. When the NKT was added to the combined mental ability test and high school records now used for prediction, the battery validity was raised from about .40 to .50 for Contract students and from about .37 to .45 for Regular students. No further work appears warranted in attempting to predict career motivation or grade-point average by use of the NKT.

Naval Personnel Research Field Activity, Washington, D. C.
PREDICTION OF OFFICER CANDIDATE MILITARY APTITUDE GRADES AND PEER RATINGS, by Rosemary Cliff and David Kipnis. June 59, 17p. 12 refs. BuPers Technical Bulletin 59-11; AD-227 794
Order from LC mi$2.40, ph$3.30 PB 144 538

This study was designed to develop tests which could be used in initial selection to predict military aptitude grades, peer ratings of officer candidates, and ultimately junior officer performance as evaluated by Fitness Reports. The Biographical Information Blank and the Risk Scale were found to be valid in predicting military aptitude grades and peer ratings. The results of the study indicate that officer selection for military aptitude can be improved by the use of some of the experimental instruments considered in this study.

Naval Personnel Research Field Activity, Washington, D. C.
THE VALIDITY OF THE BASIC TEST BATTERY AT NUCLEAR PROPULSION SURFACE SCHOOL, by Leonard Wollack. July 59, 16p. 5 refs. BuPers Technical Bulletin 59-17.
Order from LC mi$2.40, ph$3.30 PB 144 535

This study presents current information on the effectiveness of the Basic Test Battery (BTB) in selecting enlisted personnel for the Nuclear Power (NP) Surface School training program and the validity of the BTB in "fast" and "slow" training sections. Among the tests of the BTB, Arithmetic (ARI) was the best single predictor of school performance. Mechanical Comprehension (MECH) was the poorest. The MECH score added to either the General Classification Test (GCT) or ARI tended to lower prediction. Three of the Arco tests (Pre-Engineering, Mathematics, and Physics) gave predictions in this sample superior to that obtained with BTB scores. Tests of the BTB and the Arco achievement tests gave better prediction of school performance in the fast sections than in the slow sections. While the differences in prediction of fast and slow sections were not statistically significant, with the exception of the Physics test, the direction of the correlative differences was consistent with previous research findings.

Teachers Coll., Columbia U., New York.
PROBABILITY AND STATISTICS IN ITEM ANALYSIS AND CLASSIFICATION PROBLEMS; OPTIMAL TEST DESIGN IN A SPECIAL TESTING SITUATION, by Rosedith Sitgreaves. Sep 57, 36p. 5 refs. AFSAM-57-117; AD-157 698.
Order from LC mi$3.00, ph$6.30 PB 144 788

This paper considers a slightly different and more restricted model for tests of a single ability Y than the model formulated in an earlier study. It is assumed that all test items measure the same underlying variable X which has a correlation $(\rho^*)^{1/2}$ with Y. An index h, defined as one minus the minimum expected squared error of estimate of Y attainable with a given test, is adopted as a measure of the "goodness" of the test. For a given k-item test, the estimation procedure with minimum squared error of estimate is found, and the value of h is determined. Various properties of h are demonstrated, and values of the test parameters which maximize this index are found. (Author)

Psychology

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
STUDIES IN RESEARCH METHODOLOGY. I. COMPATIBILITY OF PSYCHOLOGICAL MEASUREMENTS WITH PARAMETRIC ASSUMPTIONS, by James V. Bradley. Rept. on Contract AF 33(616)3404. Sep 59, 26p. 5 refs. WADC Technical rept. 58-574(I).
Order from OTS $0.75 PB 161 335

The compatibility of typical psychological measurements with the assumptions of common, parametric, statistical tests is examined. Empirically obtained distributions of time scores and mathematically derived error distributions are used to illustrate conditions which give rise to serious violation of assumptions. (Author)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
NOTE ON RELATIVE EFFICIENCY OF TESTS, by Colin R. Blyth. Technical rept. no. 16 on Contract Nonr-225(21). 27 Nov 57, 13p. 6 refs. AD-149 891.
Order from LC mi$2.40, ph$3.30 PB 137 997

This note is concerned with possible definitions of relative efficiency for two sequences of tests of the same hypothesis. For two examples of one kind of definition, relative efficiences of the Student test and sign test against normal alternative are calculated for fixed sample size and asymptotically.

Applied Psychological Services, Wayne, Pa.
TECHNIQUES FOR EVALUATING OPERATOR LOADING IN MAN-MACHINE SYSTEMS: A DESCRIPTION OF A MODEL AND THE RESULTS OF ITS FIRST APPLICATION, by Arthur I. Siegel and J. Jay Wolf. Rept. on Contract Nonr-2492(00). Feb 59, 104p. 12 refs.
Order from LC mi$5.70, ph$16.90 PB 144 790

A "model" was synthesized which may permit an improved analysis and prediction of the effectiveness of man-machine systems. The model was then applied to

the pilots' task in landing an F4D aircraft on an aircraft carrier. The predictions from the model, presented and evaluated in this report, generally conform with reality, are generally reasonable, and indicate that many conditions necessary to the eventual fruition of a final model have been met. It further seems possible that the model may be effectively used at the present time for comparative evaluation of alternative designs. (Author)

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
AN EXPLORATORY STUDY INTO THE EFFECTS OF LOW BLAST PRESSURE ON BEHAVIOR IN RHESUS MONKEYS, by John Romba and Paul Martin. Oct 59, 21p. 24 refs. Technical Memo. 11-59.
Order from LC mi$2.40, ph$3.30 PB 144 713

Four psychological-test-sophisticated Rhesus monkeys were exposed to 90 shots of 5-7 pounds per square inch blast peak overpressures and changes in behavioral phenomena were noted. Interference with performance improvement on learning tests was apparent. Selective decrements in motor coordination were also noted. No locomotor activity changes were observed. The changes, however, cannot be interpreted as only blast pressure effects. The psychological experience of the blast situation to the animals must also be considered as a contributing factor. The elimination or reduction of confounding factors will be attempted in the next series of experiments. (Author)

Hearing and Communication Lab., Indiana U., Bloomington.
RECOGNITION MEMORY AND THE OPERATING CHARACTERISTIC, by James P. Egan. Technical note on Research Concerning the General Problem of Information Reception by Means of Speech Communication, Contract AF 19(604)1962. 15 June 58, 56p. 11 refs. AFCRC-TN-58-51; AD-152 650.
Order from LC mi$3.60, ph$9.30 PB 137 944

The present study, undertaken in the spirit of an exercise, attempts to show how the operating characteristic may be applied in the investigation of recognition memory.

Massachusetts Mental Health Center, Boston.
STUDIES IN HUMAN ISOLATION, by Sanford J. Freedman and Milton Greenblatt. Rept. for 15 Apr 58-14 Apr 59 on Biophysics Research, Contract AF 33(616)5663. Sep 59 54p. 34 refs. WADC Technical rept. 59-266.
Order from OTS $1.50 PB 161 349

Thirty normal college-age subjects were run in eight-hour experimental sessions involving (a) non-patterned visual and auditory input combined with social isolation, (b) visual deprivation (blackout) combined with auditory non-patterning and social isolation, and (c) social isolation alone. Perceptual and cognitive distortions and disorientations differentially induced by these conditions are described. Six additional somewhat "deviant" subjects were run under (a). A good quantitative measure of perceptual distortion was developed. Both perceptual and cognitive effects occur with either non-patterning or blackout of the visual field, but social isolation subjects experience essentially no effects. There is no consistent relationship between the two kinds of effects. The visual imagery reported strongly resembles hypnagogic imagery and this experience is related to a history of hypnagogic imagery. A theoretical formulation is proposed which would attribute the perceptual distortions to the organism's continuous automatic search for order in a non-ordered perceptual environment. (Author)

Mississippi Southern Coll., Hattiesburg.
MULTIDIMENSIONAL SCALING APPROACH TO THE DETERMINATION OF BASIC PSYCHOLOGICAL PARAMETERS FOR PURE TONES, by Robert W. Peters. Rept. on Research on Psychological Parameters of Sound, Contract AF 33(616)3644. Apr 59, 42p. 12 refs. WADC Technical rept. 59-201.
Order from OTS $1.25 PB 161 316

The multidimensional scaling model of successive intervals was applied to investigate the dimensionality of auditory perception of pure tones. The stimuli consisted of 16 pure tones. Thirty-nine observers made distance judgments of similarity between stimuli. These inter-stimuli distances were analyzed mathematically to reveal the minimum number of dimensions necessary to account for the distances between stimuli. The results of the analysis indicated that there were two dimensions, pitch and loudness. The purpose of the study was to evaluate the multidimensional scaling method for use in auditory areas where the dimensions are not well known, and, since the two anticipated dimensions, pitch and loudness, were revealed, proposed use of the model in other auditory areas is supported. (Author)

Naval Research Lab., Washington, D. C.
DECISION-MAKING STUDIES. PART I. THE TRADE-OFF OF VARIABLES IN DECISION MAKING, by J. R. Hayes and Elizabeth C. Smith. 6 Jan 60, 9p. 13 refs. NRL rept. 5418.
Order from OTS $0.50 PB 161 052

Subjects were required to make tactical decisions based on three variables (speed, distance, and number of airplanes) in a simulated air-defense situation. The experimentally varied factors were: (a) the amount of trade-off required for decision (correlation), (b) the adequacy of the forces available to the decision maker (adequacy), and (c) the form in which the information was displayed (arrangement). The dependent factor was decision time. It was shown that at least some properties of complex decisions can be described without recourse to economic theory. (Author)

Princeton U., N. J.
A REVIEW OF FACTORS IN LEARNING EFFICIENCY, by Robert M. Gagne and Robert C. Bolles (U. of Pennsylvania). Nov 58, 31p. 58 refs. AFOSR-TN-58-924; AD-162 275.
Order from LC mi$3.00, ph$6.30 PB 137 897

The main body of this report deals with principles derived from laboratory findings and theoretical writings that seem relevant to the problem of promoting efficient learning. In describing these factors and their origin, we have not attempted to provide a detailed review containing all relevant references. Instead, reference is usually made to a key paper, set of studies, or to an authoritative work summarizing the field. Consideration is given to the kind of evidence which exists, the suggestions it has for learning efficiency, and its adequacy in dealing with this problem. Some conclusions are drawn regarding the present state of knowledge of these principles and the research questions which appear to be in need of investigation.

Research Center for Human Relations, New York U., N. Y.
CONDITIONS AFFECTING COOPERATION. SECTION I: FACTORS RELATED TO THE INITIATION OF COOPERATION. SECTION II: TRUST AND COOPERATION, by Morton Deutsch (Bell Telephone Labs.) Final technical rept. on Contract Nonr-285(10). Feb 57, 129p. 22 refs. AD-124 701.
Order from LC mi$6.30, ph$19.80 PB 144 604

This report presents in final summary the theoretical thinking and the research studies done on conditions affecting cooperation. The work proceeded in two phases. In the first phase a series of studies was conducted under the general framework of a theoretical outline concerning the factors which influence the initiation of cooperation. In the second phase, the focus of theorizing and research centered upon some of the unique social psychological factors involved in the initiation of cooperation - namely, the factors related to the development of mutual trust.

Willow Run Labs., U. of Michigan, Ann Arbor.
THE BEHAVIORS OF MEMBERS OF PROBLEM-SOLVING GROUPS, by L. R. Hoffman and C. G. Smith. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Feb 59, 31p. 8 refs. 2144-364-T.
Order from LC mi$3.00, ph$6.30 PB 144 548

This report investigates the variables determining the individual behaviors of members of 4-person problem-solving groups on 4 different problems, as derived from postmeeting ratings of their behaviors. A complex analysis-of-variance design is used to test for the effects of group type (homogeneity vs heterogeneity of member personalities), problems, and between-group and between-individual differences. Problem differences proved to be a major source of variance for all behaviors studied, with some problems eliciting task-directed behaviors and others more socio-emotional behaviors. Between-group differences and interactions between problems and groups were also large sources of variance. The only significant difference bewteen the homogeneous and heterogeneous groups was that the homogeneous groups engaged more in promoting personal relations. Results are discussed, and some basic propositions of group interaction are suggested. (Author)

BIOLOGICAL SCIENCES

Pennsylvania State U. [University Park].
BIOLOGICAL EFFECTS OF NOISE IN VERTEBRATE ANIMALS, by Adam Anthony and Eugene Ackerman. Rept. for 1 June 54-30 Sep 57 on Generation, Propagation, Action and Control of Acoustic Energy, Contract AF 33(616)2505. Nov 57, 128p. 54 refs. WADC Technical rept. 57-647; AD-142 078.
Order from LC mi$6.30, ph$19.80 PB 144 606

This report deals with the stress effects of noise on bodily functions other than hearing. It includes physiological, biochemical and behavioral effects of intense acoustic noise at low and high frequencies. Specific approaches employed are as follows: (1) flame spectrophotometric analyses of serum electrolytes, (2) serum ascorbic acid and blood sugar changes, (3) changes in adrenal and plasma cholesterol, (4) behavioral changes in noise exposed rats, mice and guinea pigs, (5) relationship of seizure-susceptibility to noise stimulation and (6) design and construction of a corona speaker for use in bioacoustic studies. It was demonstrated that short daily exposures to intense noise of about 132-140 db pressure levels can act as a physiological stress to which rats, mice and guinea pigs can satisfactorily adapt. These studies have also helped clarify the nature of the normal physiological defense mechanisms to excessive noise stimulation. By investigating the factors determining the severity of noise as a stress stimulus and using objective measures of the limits of endurance of animals to different types of intense noise situations, one can more intelligently cope with the problem of preventing noise from becoming a serious health menace to man. (Author)

Vermont U., Burlington.
THE METABOLISM OF CONNECTIVE TISSUE, by William v. B. Robertson. Final rept. on Contract N9onr-82800. [1953] 4p. 7 refs. AD-23 248.
Order from LC mi$1.80, ph$1.80 PB 137 884

A bibliography of published manuscripts on (1) the chemical structure and physical properties of connective tissue constituents such as hyaluronic acid complexes, (2) the formation and destruction of collagen as affected by vitamins and hormones, and (3) the mechanism of formation of collagen and the role of ascorbic acid and hyaluronate in this process.

Anatomy and Physiology

Air Force Missile Development Center, Holloman AFB, N. Mex.
THE ANALYTICAL MECHANICS OF RATE OF ONSET, by Sigurd Hoyer (Potter Instrument Co.). Oct 59, 66p. 5 refs. AFMDC-TN-59-26.
Order from LC mi$3.90, ph$10.80 PB 144 424

The system investigated in Part I consists of a mass connected by a linear spring to a moving frame. One calculation also includes the effect of a Newtonian dashpot connected to oppose relative motion between the mass and the frame. The force in the coupling spring is determined as a function of the motion of the frame. The force depends on the acceleration of the frame, and on higher derivatives of the position of the frame with respect to time. We are here particularly interested in the effect on spring force of the rate of onset of acceleration of the frame. It is shown that the spring force may depend on the rate of onset of acceleration only. The purpose of Part II is to present the results of an investigation of the behavior of certain models when these models are subject to accelerated motion. The models treated here consist of a rigid frame holding either a frictionless compressible fluid, an elastic solid, or a visco-elastic solid. Equations which describe the behavior of the models are developed. Solutions of these equations are given for some particular cases. It is hoped that the results obtained will be of use in determining factors which cause damage to living organisms during periods of severe acceleration. Such periods of severe acceleration may, for example, occur in a plane crash, or in a rocket-powered flight with living passengers. (See also PB 142 846)

Albany Medical Coll., N. Y.
RENAL CLEARANCE OF GLUCOSE IN HYPOTHERMIC DOGS, by G. S. Kanter. July 59, 15p. 10 refs. AFSAM rept. 59-37; AD-227 573.
Order from LC mi$2.40, ph$3.30 PB 144 688

The quantitative alterations in both glomerular filtration rate (GFR) and tubular reabsorption of glucose, before, during, and after onset of hypothermia were investigated. With the development of hypothermia a progressive fall in glomerular filtration rate was observed (78 ± 5 ml/min. at control rectal temperature to 30 ± 5 ml/min. at RT of 25° C). Hypothermia has a twofold effect on renal function — physically via the cardiovascular system, resulting in a falling GFR, and chemically via the tubular reabsorption processes, resulting in a decreased glucose reabsorption. To study the kinetics of this decreased glucose reabsorption, the glucose Tm was investigated.

Dayton U., Ohio.
A MINIATURIZED OPERANT CONDITIONING CHAMBER FOR BEHAVIORAL RESEARCH IN THE UPPER ATMOSPHERE, by Frederick H. Rohles, Jr. (Aero Medical Lab.) and Richard Coy. Rept. on Human Performance in Advanced Systems, Contract AF 33(616)6264. July 59, 13p. 3 refs. WADC Technical note 59-261.
Order from OTS $0.50 PB 161 333

A miniaturized operant conditioning chamber for a mouse was designed for behavioral research in the upper atmosphere. It requires the animal to press a lever on a fixed ratio schedule of 25:1 for 20 minutes out of every 6 hours for food reward. The chamber utilizes mechanical power, and response recording is compatible with telemetry systems. The unit is 3.5 inches in diameter, 6.5 inches long, and weighs approximately 2.25 pounds. (Author)

Virginia U., Charlottesville.
BIOLOGICAL PAYLOADS IN SPACE FLIGHT, by Frank W. Banghart. Rept. on Contract AF(600)1792. Nov 58, 49p. ARDC-TR-58-58; AD-204 761.
Order from LC mi$3.30, ph$7.80 PB 144 586

An experimental program is proposed to determine the feasibility of manned space flight by means of a series of experiments designed to furnish the maximum amount of information, in progressive steps, from lower animal species to the ultimate manned flight. The basic instrumentation problem involves obtaining highly reliable and information-rich data from a space vehicle which may not be recovered, using minimum instrumentation weight. It is proposed that a storage-dumping procedure be used where the data are taped and stored and are dumped at the command of the monitoring station. The basic ecological problem consists of determining and controlling the environment in which a living organism is to be sent into space. The basic physiological problems considered are the specific areas of gravity and radiation.

Biochemistry

Army Chemical Warfare Labs., Army Chemical Center, Md.
SOME ASPECTS OF THE CHEMISTRY AND BIOCHEMISTRY OF DECABORANE, by David L. Hill. Nov 58, 11p. 10 refs. CWL Special pub. 2-15.
Order from LC mi$2.40, ph$3.30 PB 138 343

Part of report has been published.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
CHANGE IN PLASMA TRANSAMINASE ACTIVITY OF RHESUS MONKEYS AFTER EXPOSURE TO VIBRATION, ACCELERATION, HEAT ON HYPOXIA, by Freeman W. Cope and B. David Polis. Rept. no. 5 on Proj. NM 11 01 12.7. 11 Dec 57, 10p. 8 refs. NADC-MA-5718; AD-209 173.
Order from LC mi$1.80, ph$1.80 PB 144 717

Significant increases in plasma glutamic-oxalacetic transaminase levels were observed in monkeys exposed to vibration, acceleration, heat, hypoxia, or noise and confinement stress. In all but 1 of 17 animals, no specific tissue damage was evident. The increase in plasma transaminase is interpreted as a non-specific stress effect. The data suggest that caution should be exercised in basing clinical judgements on serum transaminase levels. (Author)

Botany

Arizona U. Coll. of Agriculture, Tucson.
PHOTOGRAPHIC DOCUMENTATION OF VEGETATIONAL CHANGES IN AFRICA OVER A THIRD OF A CENTURY, by H. L. Shantz and B. L. Turner.

Rept. on Contract [Nonr-2173(01)] Aug 58, 173p. 6 refs. Rept. 169.
Order from LC mi$8.10, ph$27.30 PB 143 349

The present photographic study has been to document the changes which have taken place at a particular site over a specified time. The area covered is large enough so that broad generalities might be drawn. The facts are presented from which each worker can draw his own conclusions. The duplicated pictures and discussions have been arranged in accordance with the broad vegetational belts or formations.

Syracuse U., N. Y.
CONTROL OF WOOD-ROTTING FUNGI, by M. W. Johnson. Technical rept. no. 9, 1 Jan-31 Dec 58, on Contract Nonr-669(06). [1958] 11p.
Order from LC mi$2.40, ph$3.30 PB 144 686

Abstracts of results are given on studies: (a) on utilization of isomers of amino acids; (b) on vitamin; (c) on polysaccharide production; and (d) on marine fungi.

Medical Specialties and Equipment

Electrical Engineering Research Lab., U. of Illinois, Urbana.
THE REALIZATION OF BIOLOGICAL COMPUTERS. Quarterly rept. no. 4 (Annual) on Contract Nonr-1834(21). 15 Jan 59, 69p. 6 refs.
Order from LC mi$3.90, ph$10.80 PB 144 682

The following topics are covered: Sec. 1. Some mathematical aspects of the analysis and synthesis of biological computers, Sec. 2. Biological computer general neuron circuitry, and Sec. 3. On the design of artificial nerve nets.

School of Aviation Medicine, Brooks AFB, Tex.
A STANNOUS FLUORIDE-SILEX-SILICONE DENTAL PROPHYLAXIS PASTE WITH ANTICARIOGENIC POTENTIALITIES, by Vincent A. Segreto, Norman O. Harris, and Warren R. Hester. Nov 59, 7p. 8 refs. Rept. 60-11; AD-227 574.
Order from LC mi$1.80, ph$1.80 PB 144 687

A stannous fluoride-silex-silicone dental prophylaxis paste was developed and tested in vitro for anticariogenic potentialities. The active ingredient is stannous fluoride; the silex acts as the abrasive, and the silicone-petrolatum dilution acts as the moistening agent. Flavoring agents consist of oil of orange, oil of anise, and Sucaryl. Data indicate that the prophylaxis paste is more effective in preventing acid decalcification of enamel than a 10 percent topical application of aqueous stannous fluoride. (Author)

Pharmacology and Toxicology

Army Chemical Warfare Labs., Army Chemical Center, Md.
CUTANEOUS APPLICATION OF 1.1% MALATHION POWDER TO VOLUNTEERS, by Philip J. Gutentag. July 59, 11p. 11 refs. CWLR-2290.
Order from LC mi$2.40, ph$3.30 PB 144 668

A pilot study is described to determine the safety with which 1.1% malathion powder can be used when dusted over a person's entire body. The study also attempts to evaluate troop reaction to frequent dustings. During the entire study, consisting of eight complete cutaneous dustings in a 15-day period, there was no significant cholinesterase depression which could be ascribed to the malathion and there was no evidence of toxicity as determined by daily examination of the men. Troop acceptances of the powder throughout the experiment was good and there was no evidence that nonpowdered personnel objected to the presence of the powdered volunteers. From these studies, it appears that 1.1% malathion could safely be used on a large-scale field trial. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE EFFECT OF HEF-3 ON LUNG TISSUE, by Edmund F. Murtha, David L. Hill and others. Preliminary rept. Apr 58, 6p. 2 refs. Technical memo. no. 26-7.
Order from LC mi$1.80, ph$1.80 PB 144 666

Army Chemical Warfare Labs., Army Chemical Center, Md.
INHALED GB RETENTION STUDIES IN MAN AT REST AND DURING ACTIVITY, by Fred W. Oberst, James W. Crook and others. Aug 59, 26p. 15 refs. CWLR-2296.
Order from LC mi$2.70, ph$4.80 PB 144 684

Resting men were exposed to GB vapor by the oral and nasal routes. Exercising men also received GB vapor by the oral route. The experiment was designed to measure the retained dose of inhaled GB and relate this with RBC-ChE inhibition. The inhibition of RBC-ChE was measured in each man after the exposure from which the ChE50 dose was calculated. (Author)

Kettering Lab., U. of Cincinnati, Ohio.
TOXICITY OF BERYLLIUM, by J. Cholak, L. H. Miller, and Frank Princi. Quarterly progress rept. on Contract AF 33(600)37211. 28 Jan 59, 30p. 50 refs. AMC Technical rept. 7-665.
Order from OTS $0.75 PB 161 319

This report, based upon current knowledge and experience, has been prepared as a review and as a

preliminary guide for use by individuals who have the responsibility for protecting the health of personnel engaged in operations in which beryllium is used. It includes descriptions of the effects of the absorption of beryllium and specific measures designed to prevent illness and maintain health among persons who work with beryllium. A proper recognition of the hazardous potentials of this material and an understanding of the basic hygienic principles described herein should result in safe handling and the avoidance of illness. (Author)

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
BERYLLIUM TOXICITY LECTURE, by A. H. Holland, Jr. [1948] 9p. AD-206 718; ATI-181 247.
Order from LC mi$1.80, ph$1.80 PB 138 454

Radiobiology

Army Medical Research Lab., Fort Knox, Ky.
MASSIVE DOSE IRRADIATION OF THE MAMMALIAN CENTRAL NERVOUS SYSTEM, by Jack M. Ginsburg and David D. Ulmer. Rept. on Biological and Medical Aspects of Ionizing Radiation. 29 May 58 21p. 27 refs. Rept. no. 339; AD-160 343.
Order from LC mi$2.70, ph$4.80 PB 144 714

5000 r of Cobalt 60 gamma rays delivered to the canine head caused a decrease in the cerebral cortex potassium content. Irradiated animals failed to show significant differences in sodium, chloride, and water content of the brain and in the dextrose, gases, and electrolyte content of blood entering and leaving the brain when compared to a control group of sham-irradiated dogs. (Author)

George Washington U., Washington, D. C.
PROCEEDINGS OF TRI-SERVICE CONFERENCE ON BIOLOGICAL HAZARDS OF MICROWAVE RADIATION, 15-16 JULY 1957, ed. by Evan G. Pattishall (U. of Virginia). Rept. on Contract AF 18(600)1180. [1957] 127p. 245 refs. ARDC-TR-58-51; AD-115 603.
Order from LC mi$6.30, ph$19.80 PB 144 603

Contents:
A summary of the SAMUSAF program for research on the biomedical aspects of microwave radiation
Future microwave radiation hazards
High power microwave facilities
Program for the investigation of the biological effects of electromagnetic radiation at the Rome Air Development Center
Summary of talk on hazards of electromagnetic radiation to ordnance
Summary of talk on exposure of Air Force personnel to ionizing radiation produced by radio frequency generators
The physiological basis of RF-injury
Heating characteristics of laboratory animals exposed to 10-centimeter microwaves
Summary of remarks on RF measurement
Microwave exposure discussion

CHEMISTRY

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
PERARYLATED SILANES. IDENTIFICATION BY X-RAY DIFFRACTION POWER PATTERNS, by Frank L. Chan and Leonard Spialter. Rept. on Analytical Chemistry of Special Alloy Chemicals. Sep 59, 37p. 13 refs. WADC Technical rept. 59-512.
Order from OTS $1.00 PB 161 312

X-ray powder diffraction data are presented for twenty arylsilanes in various forms of graphic presentation for ease in identification, characterization, and analysis. These include the actual pictorial diffraction patterns, extended listings of d-spacings with relative intensities, and a Hanawalt-type index identifying the catalogued compounds by means of all combinations of the three most intense lines. Purity of silanes is stressed to minimize confusion and errors arising from impurities and polymorphic forms. To insure accuracy in measuring distances and intensities of lines on the diffraction plates, recordings of their microphotometer traces were taken and precisely read. A surprising similarity of d-spacings had been observed for the most intense line, but not for those of lesser intensity, in the powder pattern of each of these compounds. This suggests a possible correlation between this pattern component and a basic element of molecular structure in a class of compounds.

New York U. Coll. of Engineering, N. Y.
RESEARCH ON THE PREPARATION OF PURE METALS, by Charles J. Marsel and Walter Brenner. Scientific rept. no. 3 for 15 Dec 58-31 Aug 59 on Contract AF 19(604)4124. 1959, 47p. 17 refs. AFCRC-TN-59-190; AD-215 624.
Order from LC mi$3.30, ph$7.80 PB 144 572

The preparation of pure tin was investigated via the decomposition of stannane. The preparation of pure gallium was first investigated via the reduction of gallium trichloride with lithium aluminum hydride in diethyl ether as a solvent. A more promising approach has now been developed which is centered on the preparation of lithium gallium hydride. Exploratory investigations were carried out on the preparation and the subsequent decomposition of antimony hydride for the preparation of the pure metal. (See also PB 142 291)

Wisconsin U., Madison.
BINARY NITROGEN COMPOUNDS OF THE ELEMENTS: A LITERATURE SURVEY, by Rosemary G. Ehl, Rodney J. Sime, and John L. Margrave. Rept. on Contract AF 33(616)3023. June 59, 81p. 832 refs. WADC Technical note 59-115.
Order from OTS $2.25 PB 161 315

A literature survey has disclosed the existence of more than 195 binary compounds of nitrogen with the other elements of the periodic system. About 80% of the known binary nitrogen compounds are nitrides while the rest are azides. Combinations with at least 75 elements are reported. In this report are presented a comprehensive bibliography and a set of tables designed to make it convenient for a researcher to locate preparative, crystallographic, or thermodynamic data. Miscellaneous references are also listed. (Author)

Organic Chemistry

Frick Chemical Lab., Princeton U., N. J.
THE EXPECTED SQUARE OF THE LENGTH OF A HYDROCARBON CHAIN, by Arthur V. Tobolsky. Rept. on Contract Nonr-1858(07). 29 Jan 59, 8p. 3 refs. ONR Technical rept. RLT-29.
Order from LC mi$1.80, ph$1.80 PB 144 143

Three successive bonds along a hydrocarbon chain may be in a planar trans configuration or in two nonplanar gauche configurations. The energy of the trans configuration is taken as zero and the energies of the two gauche configurations are each taken as ε (per mole). The mean square length of a hydrocarbon type chain of n links each of length l_o is shown to be $\overline{r^2} = (2+6a)/(3-3a)\, nl_o^2$, where $a = 1/[1+2\exp(-\varepsilon/RT)]$. The problem of excluded volume is not here considered.

Rochester U., New York.
THE FLUORESCENCE AND PHOTOLYSIS OF ACETONE AND ACETONE-BIACETYL MIXTURES, by Julian Heicklen and W. Albert Noyes, Jr. Rept. on Contract AF 18(600)1528. 12 Sep 58, 24p. 15 refs. AFOSR-TN-58-845; AD-203 335.
Order from LC mi$2.70, ph$4.80 PB 138 347

The photolysis of acetone has been redone to very low conversions. Also the fluorescence and photolysis of acetone-biacetyl mixtures have been studied. This paper presents the results of these studies.

Physical Chemistry

[Arkansas U., Fayetteville].
PHOTOLYSIS OF AMORPHOUS LEAD AZIDE, by [Herbert M. Dumas, Jr.] Rept. on Contract DA 44-009-eng-2439. 31 Aug 56, 52p. 32 refs. AD-124 361.
Order from LC mi$3.60, ph$9.30 PB 137 724

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE EFFECT OF POLYMERIC MODIFIERS ON THE BREAKUP OF DROPS BY HIGH-VELOCITY AIR STREAMS, by J. D. Wilcox, R. K. June and others. Rept. for Mar 56-July 58 on Agent Physicochemical Research. Sep 59, 22p. 24 refs. CWLR 2309.
Order from LC mi$2.70, ph$4.80 PB 144 740

The breakup of liquids was studied with a miniature shock tube, simulating conditions that occur in spraying from high-speed aircraft and in explosive dissemination. Investigated was the breakup of drops of agent simulants (Newtonian liquids) and of polymer solutions in agent simulants (non-Newtonian viscoelastic liquids), when subjected to a high-velocity air stream. It was found that polymeric modifiers which produce viscoelastic properties retard the breakup of the liquid.

Avco-Everett Research Lab., Everett, Mass.
NUMERICAL CALCULATION OF ABSOLUTE BREMSSTRAHLUNG INTENSITY FOR A FULLY IONIZED FULLY DISSOCIATED HYDROGENIC GAS, by G. Sargent Janes and Harold E. Koritz. Rept. on Contract AF 49(638)61. Sep 59, 16p. 4 refs. Research rept. 70; AFOSR-TN-59-1076.
Order from LC mi$2.40, ph$3.30 PB 144 345

Using the approximate relationships of Kirkpatrick and Weidmann for bremsstrahlung intensities, numerical calculations have been made on the IBM 650 at the Avco-Everett Research Laboratory for a fully ionized, fully dissociated hydrogenic gas. The intensities are given in terms of a quantity having the units ergs per sec per unit frequency interval per steradian per cubic centimeter as a function of $h\nu$, (from 0.5 to 4.0 electron volts) and kT (from 4 to 200 electron volts). A calibration method has been devised for measurement of absolute bremsstrahlung intensities, which continually compensates for the errors present in most calibration procedures.

Eagle-Picher Research Labs., Miami, Okla.
STUDY OF THE PHYSICAL CHEMISTRY AND METALLURGY OF SEMI-CONDUCTING MATERIALS, by K. E. Bean, W. E. Metcalf, and R. J. Starks. Quarterly rept. no. 11, 14 Sep-14 Dec 57, on Contract DA 36-039-sc-74890. [1957] 40p. 14 refs. AD-154 771.
Order from OTS $1.00 PB 161 353

A method was developed for the deposition of crystalline bars of silicon on a tantalum filament in such a manner as to allow the filament to be pulled out of the bar. Absorption of impurities from trichlorosilane using a quartz column containing freshly produced silica reduced the boron content of the silicon produced. Coordination compounds of BCl_3 were produced in crude $SiHCl_3$ using (1) octyl alcohol and (2) triphenylchloromethane to reduce the boron content of the silicon prepared therefrom. Floating zone studies were carried out on the silicon bars which had been pulled directly from the filaments. The symmetry of the bars made them zone more easily and retain their shape more readily than was the case of bars cut from grown crystals of silicon.

Horizons, Inc., Cleveland, Ohio.
ELECTRODE REACTIONS IN TITANIUM FUSED SALT ELECTROLYSIS, by A. J. Kolk. Final rept. on Contract Nonr-1178(00). 1 Aug 56, 150p. 20 refs.
Order from LC mi$7.20, ph$22.80 PB 138 422

Constant current voltammetry in molten salts is discussed as well as various phenomena associated with crystal growth during electrodeposition in molten salts. These include kinetics of cathodic deposition electrical double layers and transference in molten salts. Experimental data is presented on polarization curves of potassium fluotitanate in sodium chloride, the reduction of various titanium compounds to titanium, anodic and cathodic polarization curves of some titanium compounds. The appendix contains translations of articles on the electrochemistry of potassium fluotitanate.

Illinois U., Urbana.
ANODIC BEHAVIOR OF COPPER IN HYDROCHLORIC ACID AND IN PHOSPHORIC ACID (INCLUDING SCIENTIFIC REPORT ABOUT INTERNATIONAL SYMPOSIUM ON PASSIVITY, DARMSTADT, 1957) by J. H. Bartlett, R. S. Cooper and others. Technical rept. no. 5 (Final) on Contract DA 11-022-ORD-939. 30 Sep 57, 20p. 8 refs. AD-145 599.
Order from LC mi$2.40, ph$3.30 PB 144 563

An experimental study of the behavior of copper anodes in hydrochloric acid and in phosphoric acid, in order to learn more about how layers are formed and removed from electrodes. This is of fundamental importance in electrolytic rectification, electropolishing, prevention of corrosion, and the understanding of nerve conduction.

Instituto Nacional de Tecnica Aeronautica Esteban Terradas (Spain).
AEROTHERMOCHEMISTRY, by Gregorio Millan. Rept. on Contract AF 61(514)441. Jan 58, 584p. 252 refs. AFOSR TR-58-27; AD-152 202.
Order from LC mi$11.10, ph$89.40 PB 133 766

Based on the course conducted by Prof. Theodore von Kármán at the University of Paris.
Chap. 1. Thermochemistry
Chap. 2. Transport phenomena in gas mixtures
Chap. 3. General equations
Chap. 4. Combustion waves
Chap. 5. Structure of the combustion waves
Chap. 6. Laminar flames
Chap. 7. Turbulent flames
Chap. 8. Ignition, flammability and quenching
Chap. 9. Flow with combustion waves
Chap. 10. Aerothermodynamic field of a stabilized flame
Chap. 11. Similarity in combustion applications
Chap. 12. Diffusion flames
Chap. 13. Combustion of liquid fuels. Appendix: Application of Probert's method for the combustion of fuel sprays

Instituto Nacional de Tecnica Aeronautica Esteban Terradas (Spain).
DISTRIBUTION OF RADICALS IN LAMINAR FLAMES. I. CRITERIUM OF VALIDITY OF THE STEADY STATE ASSUMPTION, by G. Millan, and I. Da Riva. Rept. on Contract AF 61(514)997. 31 Jan 59, 38p. 14 refs. AFOSR-TN-59-626; AD-217 811.
Order from LC mi$3.00, ph$6.30 PB 143 173

The determination of the distribution of the chemical radicals in the sine of the flames constitutes one of the basic problems in the study of these. Von Karman and Penner [Selected Combustion Problems, pp. 5-41. Butterworth's Scientific Publications, 1954] have proposed for it the extension to this case of the steady state assumption, used with success in other problems of chemical kinetics. However, a proper criterium, making it possible to determine in what cases the above assumption can be applied with sufficient guarantee, is not yet available. In this work it is demonstrated that the applicability of the assumption depends on the value of a certain dimensionless parameter, in which the effects of reaction and diffusion of the radicals are combined. Besides, a method of recurrence is developed which enables successive approximations for the distribution of the radicals to be obtained from that corresponding to the steady state. Finally a study is made of a mathematical model which, preserving all the properties of the flame, enables an easy comparison of the exact solution with the approximate ones obtained by means of the proposed methods. (Author)

Instituto Nacional de Technica Aeronautica Esteban Terradas (Spain).
DISTRIBUTION OF RADICALS IN LAMINAR FLAMES. 2. APPLICATION OF THE CRITERIUM OF VALIDITY OF THE STEADY STATE ASSUMPTION TO SEVERAL FLAMES, by I. Da Riva and G. Millan. Rept. on Contract AF 61(514)997. 31 Jan 59, 54p. 11 refs. AFOSR-TN-59-627; AD-217 812.
Order from LC mi$3.60, ph$9.30 PB 143 172

The object is to apply the criterium on the validity of the steady state assumption [PB 143 173] to various cases corresponding to flames studied by different authors. For it, the differential equation deduced for the concentration of the radical is integrated by means of the perturbation method set out in the above mentioned reference. With a view to simplifying the numerical calculation, the concentration of the principal species and of the radicals distinct from that under consideration, if existent, have been approximated by means of appropriate functions. The two first perturbations were normally sufficient to evaluate the accuracy with which the steady state assumption enables the concentration of the radicals to be calculated. The criterium set out makes it possible to prove that the steady state assumption is sufficiently approximate to calculate the concentration of the radicals in the following cases: Ozone flame, Hydrogen radical in the Hydrogen-Bromine flame and, Hydrogen flame. On the contrary, in the case of the Bromine radical in the Hydrogen-Bromine flame and particularly in the Hydrazine flame, the parameter for the validity of the assumption is very small and consequently the method

of perturbations does not converge and the steady state assumption for the concentration of the radicals gives large deviations with respect to their actual distributions. (Author)

Johns Hopkins U., Baltimore, Md.
A MASS SPECTROSCOPIC APPEARANCE POTENTIAL STUDY OF SOME BORON TRIHALIDES, by W. S. Koski, Joyce J. Kaufman and C. F. Pachucki. Technical note no. 8 on Contract AF 18(600)1526. Oct 58, 23p. 24 refs. AFOSR-TN-58-855; AD-203 497.
Order from LC mi$2.70, ph$4.80 PB 137 994

The appearance potentials of the positive ion fragments from BCl_3, BBr_3 and BI_3 were measured mass spectroscopically. These measurements permitted a determination of the averagle B-I bond dissociation energy in BI_3.

Laval U. (Canada).
KINETICS OF THE THERMAL REACTION OF HYDROGEN PEROXIDE WITH HYDROGEN, by Wendell Forst. Rept. on Contract AF 18(600)492. 25 Nov 58, 21p. 20 refs. AFOSR-TN-58-1070; AD-207 230.
Order from LC mi$2.70, ph$4.80 PB 138 351

The reaction proceeds with a pressure increase at constant volume and is thus accessible to study by the static method. At the pressures used the rate of activation is rate-determining in the unimolecular decomposition of hydrogen peroxide. When experimental results are corrected for activation by hydrogen, the reaction is found to be first order in both hydrogen and peroxide. Experimental evidence points to a low value for rate constant k_3. The significance of these results is briefly discussed in connection with the kinetics of the nitric oxide-hydrogen reaction.

National Research Labs., Ottawa (Canada)
THE SOLUTION OF AN EIGENVALUE PROBLEM (RATE OF EVAPORATION AND DECOMPOSITION OF A DROPLET OF AN OZONE-OXYGEN MIXTURE) BY MEANS OF ANALOGUE AND DIGITAL COMPUTERS, by R. Sandri. Aug 59, 18p. 1 ref. Mechanical Engineering rept. MB-15.
Order from LC mi$2.40, ph$3.30 PB 144 509

The rate of evaporation and decomposition of a droplet of a 50-50 mole percent mixture of liquid ozone and oxygen in a hot oxygen atmosphere at 20 atmospheres pressure was computed for different sizes of the droplet radius. This is an eigenvalue problem which could be solved with an accuracy of about 2 percent on the PACE analogue computer. As an accuracy check, the one-dimensional problem (rate of evaporation of a large drop) was solved also on the Bendix digital computer. The result differed by 2.2 percent from that obtained on the analogue computer. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
TRI-DIMENSIONAL EXAMINATION OF CHEMICAL SYSTEMS IN GEL MEDIA, by L. H. Gevantman, R. C. Chandler, and J. F. Pestaner. 29 May 57, 31p. 16 refs. Research and development technical rept. USNRDL-TR-163; AD-143 510.
Order from LC mi$3.00, ph$6.30 PB 144 728

The present study describes a technique for the colorimetric measurement of tri-dimensional reaction product distributions in firm aqueous gels. Two chemical systems are employed. These systems contain agar (1 per cent by weight) in combination with low concentrations of either KI-starch or trichloroethylene-bromcresol purple. The change in the KI system, colorless to deep blue, results from the radiation-induced oxidation of I^- to I_2. The change in the trichloroethylene-bromcresol purple system, purple to yellow, is caused by the production of HCl. The gels are irradiated in square tubes with X rays from a Van de Graaff accelerator and a 250-KVP X-ray machine. After irradiation they are sliced and examined in detail. The color distribution throughout the reaction zone is measured photometrically with a recording microphotometer. Depth-dose plots for the two systems are shown. (Author)

Naval Research Lab., Washington, D. C.
MICELLAR PROPERTIES OF OIL-SOLUBLE SOAPS AND THEIR SIGNIFICANCE IN DETERGENCY, by W. D. Bascom, S. Kaufman and C. R. Singleterry. Interim rept. 13 Jan 60, 19p. 39 refs. NRL Rept. 5422.
Order from OTS $0.50 PB 161 067

Oil-soluble soaps in hydrocarbon solvents have been shown to form small and approximately isodimensional micelles. Under suitable conditions, some metal carboxylates form extended structures as well. Coordinate bonding is an important factor contributing to the stability of both types of structure. Micelles are in equilibrium with nonmicellar soap in the solvent so that the system behaves as a dilute but saturated soap solution in equilibrium with a finely divided saturating phase. This situation favors rapid and extensive adsorption on polar surfaces to effect detergency or rust inhibition. The presence of micelles facilitates the dissociation of oil-soluble soaps to produce stable micellar ions and to impart a stabilizing charge to polar particles suspended in the system. The solubilization of polar molecules in oil-soluble soap micelles involves coordination and sometimes hydrogen bonding. It provides a mechanism for the segregation of corrosive acids and of acidic precursors of sludge or lacquer. Solubilization of water by such micelles promotes dissociation of ion pairs in the micelle to form micellar ions and free anions. Water solubilization also allows secondary solubilization of inorganic salts not otherwise taken up by the micelle. Addition of excess water may lead to the formation of a stable water-saturated micelle or to the separation of a soap-rich liquid-crystalline phase. (Author)

Ohio State U. Research Foundation, Columbus.
RARE EARTH OXIDES. I. THE VAPORIZATION OF NEODYMIUM SESQUIOXIDE, Nd_2O_3. DISSOCIATION ENERGY OF NdO AND TaO, by Patrick N. Walsh and David White. Technical note 1 on Contract AF 18(600)1545. Jan 58, 19p. 24 refs. AFOSR-TN-58-291; AD-154 196.
Order from LC mi$2.40, ph$3.30 PB 144 643

The vaporization of Nd_2O_3 has been studied by the Knudsen effusion method in the temperature range 2040 to 2450°K. The dissociation energies for TaO and NdO is calculated to be $D_o^o(NdO) = 7.34 \pm 0.2$ e. v.

Ohio State U. Research Foundation, Columbus.
RARE EARTH OXIDES. II. THE VAPORIZATION OF LANTHANUM SESQUIOXIDE, La_2O_3, AND YTTRIUM SESQUIOXIDE, Y_2O_3; DISSOCIATION ENERGIES OF LaO, YO, AND TaO, by Patrick N. Walsh and David White. Technical note 2 on Contract AF 18(600)1545. Feb 58, 22p. 15 refs. AFOSR-TN-58-382; AD-154 289.
Order from LC mi$2.70, ph$4.80 PB 144 642

The vaporization of La_2O_3 and Y_2O_3 from tungsten and tantalum refractories has been studied by the Knudsen effusion method in the temperature ranges 2000-2450°K, and 2000-2700°K, respectively. The sesquioxides decompose to the corresponding monoxides and oxygen on vaporization from tungsten cells. The dissociation energies of the monoxides are $D_o^o(LaO) = 8.02 \pm 0.17$ e. v., and $D_o^o(YO) = 7.25 \pm 0.3$ e. v. LaO(g) and TaO(g) are the principal products formed in the vaporization of La_2O_3 from a tantalum effusion cell. Y_2O_3 also reacts with tantalum, yielding a mixture of YO(g), Y(g), and TaO(g). From the determination of the heats of these reactions, the dissociation energy of TaO(g) is found to be $D_o^o(TaO) = 9.34 \pm .06$ e. v. A method is described for deriving equilibrium concentrations and heats of formation from Knudsen effusion data when more than one reaction occurs in the Knudsen cell. (Author) (See also PB 144 643)

Plasmadyne Corp., Santa Ana, Calif.
AN EXPERIMENTAL STUDY OF SPARK STABILIZATION BY A GAS VORTEX, by Christopher Cobb and Vernon H. Blackman. Rept. on Contract AF 49(638)334. 28 Aug 59, 23p. 3 refs. T-3TN099-334; AFOSR TN-59-925.
Order from LC mi$2.70, ph$4.80 PB 144 768

For several years, pressure gradients in a gas flow have been used to stabilize an electric discharge. This work has been concerned mainly with a vortex flow in which the low density channel along the axis of the vortex can be used to confine an electric arc. It was decided to investigate transient discharges, i. e., sparks, in the presence of a gas flow. Since the vortex geometry is of great interest for arc applications, the work was oriented toward the discharge of sparks along the axis of a vortex, with the feeling that a time resolved photographic study of spark stabilization and growth in a vortex channel could shed information on the stabilization of arcs by the vortex motion.

Purdue U., Lafayette, Ind.
THE THERMOCHEMISTRY OF RHENIUM COMPOUNDS, by James P. King (Doctoral thesis). Rept. on Contract AF 18(600)1525. 26 Oct 59, 148p. 81 refs. AFOSR-TN-59-1164.
Order from LC mi$7.20, ph$22.80 PB 144 741

Mostly covers the following: The potential of the ReO_3/ReO_4^- electrode and the thermodynamics of rhenium trioxide. The heats of formation of rhenium trichloride and rhenium tribromide. The heat of formation of the hypochlorite ion. The entropy and structure of rhenide ion.

University of Southern California, Los Angeles.
PHOTOIONIZATION ANALYSIS BY MASS SPECTROSCOPY, by G. L. Weissler, J. A. R. Samson and others. Technical rept. no. 3 on Contract AF 19(604)2049. 1 Aug 58, 50p. 64 refs. AD-202 792.
Order from LC mi$3.30, ph$7.80 PB 137 534

A vacuum ultraviolet monochromator has been combined with a mass spectrometer similar to previously reported instrumentation to study photoionization processes between 1570A and 430A. Monochromatic photons were used to ionize A, He, Ne, O_2, N_2, CO, NO, CO_2, N_2O, and NO_2; and preliminary measurements of ion intensity as a function of photon energy have been obtained for the parent ions together with their fragments. The onset of ionization and the plot of ions per unit photon flux versus λ will be compared to previously reported work on photoionization cross sections. Dissociative ionization energies have also been determined for some of the above gases, and the results for N_2O favor the N_2 dissociation energy of 9.8 ev.

EARTH SCIENCES

Maryland U., College Park.
GENERAL CARGO HINTERLANDS OF NEW YORK, PHILADELPHIA, BALTIMORE AND NEW ORLEANS, by Donald J. Patton. Rept. no. 2 on Contract Nonr-595(05). Mar 58, 25p. 13 refs.
Order from LC mi$2.70, ph$4.80 PB 138 539

The present contribution to the study of port hinterlands has three objectives. First, hinterland origin and destination maps are presented for port traffic of a general cargo nature for New York, Philadelphia, Baltimore and New Orleans, the four leading general cargo ports in the eastern half of the United States. Second, several preliminary conclusions are presented regarding factors contributing to the hinterland patterns depicted. Third, an attempt is made to suggest several of the problems which would appear to merit attention in further research relating to the spatial relations of ports. (See also PB 135 898)

Quartermaster Research and Engineering Center, Natick, Mass.
GLAZE: ITS METEOROLOGY AND CLIMATOLOGY, GEOGRAPHICAL DISTRIBUTION, AND ECONOMIC EFFECTS, by Iven Bennett. Rept. on Contract DA 44-109-qm-1496. Mar 59, 224p. 216 refs. Technical rept. EP-105; AD-216 668
Order from LC mi$9.90, ph$34.80 PB 144 450

Information is given on air mass and frontal conditions associated with glaze formation in different parts of the United States. Maps illustrate surface and upper air synoptic patterns of typical glaze storms. Considerable new information is presented on the frequency, intensity, duration, and geographical distribution of glaze. Major emphasis is on the United States, but other parts of the world, particularly Europe, are included. Bituminous or macadam highway surfaces are slightly superior to concrete in inhibiting glaze formations and in contributing to its rapid melting. Material from highway departments of 34 states describes icing conditions encountered and methods used to combat the ice.

Climatology and Meteorology

Air Force Cambridge Research Center, Bedford, Mass.
GENERAL DESIGN FOR WEATHER OBSERVING AND FORECASTING SYSTEM, 433L, by R. M. White, R. F. Myers and F. W. Ward. 15 Dec 57, 93p. 1 ref. AFCRC-TN-57-609; AD-133 846.
Order from LC mi$5.40, ph$15.30 PB 144 602

A study was made to review Air Force operational and technological weather support problems in order to recommend revisions and reorientations of the system design philosophy and development plan. No attempt was made to present a detailed plan: this is to serve as a general study which may function as a guide in the preparation of detailed engineering design plans. Topics of discussion include (1) the Air Force Weather problem, (2) system design characteristics, (3) system description, (4) system implementation, and (5) resources.

Air Force Cambridge Research Center, Bedford, Mass.
REFINEMENTS IN UTILIZATION OF CONTOUR CHARTS FOR CLIMATICALLY SPECIFIED WIND PROFILES, by Allen E. Cole. Oct 59, 28p. 118 refs. Air Force Surveys in Geophysics no. 116; AFCRC-TR-59-280.
Order from OTS $0.75 PB 161 346

Differences between mean monthly (or seasonal) wind profiles obtained from actual wind observations and those prepared from height contours of constant-pressure charts are examined. The study is divided into two parts: (a) a comparison of mean monthly vector winds based on complete sets of monthly rawin observations with geostrophic and gradient winds taken from mean monthly constant-pressure maps and (b) an investigation of the accuracy of mean monthly resultant winds computed from complete sets of rawin data. Procedures to be followed in preparing mean monthly and seasonal wind profiles from data obtained from the height contours on mean monthly constant-pressure maps are recommended. (Author)

Arizona State Coll., Flagstaff.
VODARO RESULTS FOR AUGUST 1954 THROUGH DECEMBER 1954 AT THE ATMOSPHERIC RESEARCH OBSERVATORY, FLAGSTAFF, ARIZONA, by Ewell Weems and Arthur Adel. Scientific rept. HB-6 on Infrared Spectroscopy of the Sun, Moon, and Earth, Contract AF 19(604)2177. 10 June 59, 23p. 4 refs. AFCRC-TN-59-464.
Order from LC mi$2.70, ph$4.80 PB 144 584

Vertical ozone distributions, obtained by the method of VODARO, are given for eighty-three days for the period August 54 through December 54. (Author)

Deutsche Forschungsanstalt für Segelflug (Germany).
MEASURE FLIGHTS FOR THE RESEARCH OF AEROPHYSICAL PROBLEMS; MEASUREMENT OF CLOUD ELEMENTS, ATMOSPHERIC VERTICAL VELOCITY, ATMOSPHERIC OZONE CONTENT, by Walter Georgii. Final rept. for 1 Mar 58-30 Sep 59 on Contract DA 91-508-EUC-297. 1959, 96p. 4 refs.
Order from LC mi$5.40, ph$15.30 PB 144 240

Size of cloud particles: Methods for direct and indirect determination of drop sizes in clouds are described. The methods developed are of sufficient accuracy to be applied for the determination of drop sizes. Vertical air velocity: (1) term of vertical velocity and vertical acceleration; (2) purpose of measurements concerning air traffic, missiles, gliding; (3) methods of measurements: flight measurements, combined measurements, balloon measurements (theodolite, radar); (4) own measurements; (5) vertical velocity and vertical acceleration in atmospheric boundary layers, in frontal zones, in waves, in local convection, and in mixing airmasses. Vertical distribution of ozone: Measurement flights of ozone have been carried out up to 6500 m altitude over forest areas, smaller settlements, over lakes and in the foot hills of the Alps. The flights indicated that the ozone amounts over the city have been always found smaller than over the country. The differences were not very great since the ozone content was always small over the country with the exception of flight No 11. During all other measurement flights a long period of high pressure dominated Europe with only small low pressure disturbances, which did not reach Bavaria. Correspondingly weak wind flow existed.

Deutscher Wetterdienst, Aachen (West Germany).
ATMOSPHERIC ELECTRIC AND METEROLOGICAL INVESTIGATIONS IN HIGHER MOUNTAIN RANGES, by Hans Israel. Final rept. on Alps-Proj. 1954-57, Contract AF 61(514)640. 1 Sep 57, 177p. 94 refs. AFCRC-TR-58-248; AD-152 607.
Order from LC mi$8.10, ph$27.30 PB 137 823

During a period of 13 months geophysical measurements were made at more than four stations, situated between 200 and more than 3.500 m above sea level in Switzerland. The measurements concerned in general the electric potential gradient of the atmosphere, the air-earth current, the general local brightness and the general meteorological data - and partially the two polar electric conductivities of the atmosphere, the content in condensation nuclei, the sun radiation in several spectral ranges and the ozone content. The results of the first total evaluation are given in 16 reports, four of which deal with the measuring technique. (See also PB 137 365)

Florida State U., Tallahassee.
FINAL REPORT, by Noel E. LaSeur. Rept. on Contract AF 19(604)753. 31 July 59, 24p. 23 refs.
Order from LC mi$2.70, ph$4.80 PB 144 531

Research devoted primarily to two general problems: (1) the structure, analysis and forecasting of synoptic scale weather systems in the tropical Atlantic region; and (2) hurricane structure and some aspects of its relation to the formation, movement and dissipation of these storms.

High Altitude Observatory, Boulder, Colo.
THE DEVELOPMENT OF THERMALLY DRIVEN CIRCULATIONS, by B. Haurwitz. Scientific rept. no. 1 on Contract AF 19(604)5488. Nov 59, 34p. 3 refs. AFCRC-TN-59-628.
Order from LC mi$3.00, ph$6.30 PB 144 592

Some simple models of atmospheric circulations are considered. It is assumed that a temperature difference in the horizontal is established and maintained by some outside agency, such as differential solar heating. The resulting motion is studied without and with the effects of friction. The advective temperature change which appears as a non-linear term in the differential equations is taken into account. Mathematical expressions are given for the development of the circulation without friction.

Illinois State Water Survey, Urbana.
AN EVALUATION OF THE AREA INTEGRATOR, by Eugene A. Mueller. Research rept. no. 7 on Contract DA 36-039-sc-75055. Dec 58, 37p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 144 670

The operational results of the area integrator as developed by the Illinois State Water Survey are reported. The use of a range integrating device with radar as a solution to the incoherent return from precipitation is described and found to improve the area comparisons of the area integrator to the radar. Results of the study indicate that better relationships between radar power return and precipitation rate must be determined before the area integrator becomes a useful tool. At present the quantitative amounts as determined by the area integrator are as accurate as the amounts obtained manually from the radar. (Author)

Massachusetts Inst. of Tech., Cambridge.
HEMISPHERIC HUMIDITY CONDITIONS DURING THE YEAR 1950, by Jose P. Peixoto. Scientific rept. no. 3 on General Circulation Project, Contract AF 19(604)2242. Oct 58, 146p. 9 refs. AFCRC-TN-58-609; AD-207 285.
Order from LC mi$7.20, ph$22.80 PB 137 989

A monograph is presented which contains the final outcome of an observational study of the water vapor field for the year 1950. The analysis was performed on polar stereographic maps showing the main geographical features. From these maps, zonally averaged values are obtained for any of the moisture characteristics. The moisture properties can be averaged over limited regions of the map for comparison with hydrologic and oceanographic measurements (e.g., evaporation and salinity measurements). The study is concerned only with the water in the vapor phase which is the most important form in which water is transported.

Massachusetts Inst. of Tech., Cambridge.
MEASUREMENT OF DROP SIZE DISTRIBUTION AND LIQUID WATER CONTENT IN NATURAL CLOUDS, by D. P. Keily and S. G. Millen. Scientific rept. no. 1 on Contract AF 19(604)3050. 30 Dec 58, 57p. 2 refs. AFCRC-TN-59-494; AD-228 667.
Order from LC mi$3.60, ph$9.30 PB 144 798

Cloud drop size distributions observed from aircraft are presented for 2 stratus and thin cumulus situations. As in a previous thin cumulus observation, 2- to 4-μ diameter drops predominate and liquid water content is much less than one tenth g/cu m. (Author)

Michigan U. Research Inst., Ann Arbor.
RESEARCH IN THE MEASUREMENT OF AMBIENT PRESSURE, TEMPERATURE, AND DENSITY OF THE UPPER ATMOSPHERE BY MEANS OF ROCKETS, by N. W. Spencer. Final rept. on Contract AF 19(604)545, continuation of Contract AF 19(122)55. June 58, 95p. 23 refs. 2096-18-F; AFCRC-TR-58-464; AD-203 480.
Order from LC mi$5.40, ph$15.30 PB 137 759

A summary discussion of research activities that took place under the subject contract is given. A listing of reports and papers prepared during the contract is included, as well as two appendices to formalize earlier informal letter reports.

Naval Ordnance Test Station, China Lake, Calif.
THE RELATION OF UPPER-AIR TURBULENCE TO TROPOPAUSE LAYERS, by Royal C. Gould. 1 Jan 59, 35p. 1 ref. NOTS-TP-2242; NAVORD-6544.
Order from LC mi$3.00, ph$6.30 PB 144 702

This report is concerned with the occurrence of turbulence aloft associated with tropopause layers, and is based on rawinsonde data taken at the Naval Ordnance Test Station, China Lake, over a two-year

period. Types of turbulence, frequency of occurence, and contributing weather factors are analyzed. It was found that turbulence was invariably associated with tropopauses, and the characteristics, type, and magnitude of the turbulence were attributed to the proximity, relative position, and degree of intensity of frontal activity. (Author)

Texas A. and M. Coll., College Station.
THE SYNOPTIC ANALYSIS AND FORECASTING APPLICATIONS OF RADAR WEATHER OBSERVATIONS, by Myron G. H. Ligda. Final rept. on Contract AF 19(604)1564. June 58, 131p. 39 refs. Reference 58-9F; AFCRC TR-58-251; AD-152 629.
Order from LC mi$6.90, ph$21.30 PB 138 225

The use of radar observations in intermediate range (12 to 48 hr) forecastings is treated. By application of an analytical technique which involves determination of the past, current, and future location of discrete volumes of atmosphere of high water content, elements of weather forecasting can be determined more precisely. The problems of storm structure are considered.

Weather Forecasting Research Center, U. of Chicago, Ill.
THE THERMAL FIELD OF THE ARCTIC STRATOSPHERE NEAR 80°W IN JANUARY, by E. Paul McClain. Scientific rept. no. 11 on Contract AF 19(604)2179. Sep 59, 23p. 18 refs. AFCRC-TN-59-619; AD-227 653.
Order from LC mi$2.70, ph$4.80 PB 144 689

Revised means, frequency distributions and other statistics based on 10 years of January temperature observations at the 200, 100, and 50-mb levels are presented for 4 arctic stations. The frequency distributions are shown to be markedly bimodal, a characteristic which becomes more pronounced with increasing height and latitude. Thermal conditions in the arctic and antarctic stratospheres are compared with the aid of recent IGY data. (Author)

Wisconsin U., Madison.
STUDIES ON THE STRUCTURE OF TURBULENCE, by J. A. Businger, V. E. Suomi, and H. A. Panofsky. Final rept. on Contract AF 19(604)1384. 31 Aug 58, 71p. 3 refs. AFCRC-TR-59-213; AD-210 492.
Order from LC mi$4.50, ph$12.30 PB 144 428

Contents:
A generalization of the mixing length concept
Similarity and dissimilarity between turbulent transfer of heat and momentum near the earth's surface
The spectrum of vertical velocity
Sonic anemometer thermometer observations at Hancock 1957

Geodesy

Air Force Cambridge Research Center, Bedford, Mass.
STUDY OF A PULSED LOGARITHMIC PHOTOMETER, by Michael R. Zatzick. Sep 59, 29p. 22 refs. Instrumentation for Geophysics and Astrophysics no. 11; AFCRC-TR-58-275.
Order from OTS $0.75 PB 161 344

A pulsed photometer circuit with a quasi-linear logarithmic response, covering a usable dynamic range of 5 orders of magnitude, is described in detail. A circuit analysis is given and an equation for the theoretical sensitivity curve (log of incident intensity vs. total dynode voltage) is derived. The experimental curve for the test circuit is in good agreement with the derived result. The thermionic dark current and leakage current are shown to be the factors which determine the range and linearity of the response. A semiquantitative argument is used to calculate the transient response in limiting cases, and the design requirements for optimizing the speed of response are discussed. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
A TREATMENT OF ANALYTICAL PHOTOGRAMMETRY WITH EMPHASIS ON BALLISTIC CAMERA APPLICATIONS, by Duane C. Brown. 20 Aug 57, 145p. 34 refs. RCA data reduction technical rept. no. 39; AFMTC-TR-57-22; AD-124 144.
Order from LC mi$7.20, ph$22.80 PB 143 235

The theory and the methods underlying the reduction of ballistic camera observations at the Air Force Missile Test Center are presented. (Author)

Northwestern U., Evanston, Ill.
AN ESSAY KEY FOR THE PHOTOIDENTIFICATION OF FARM CROPS AT SEVERAL INTERVALS DURING THE GROWING SEASON IN NORTHERN ILLINOIS, PART I. NATURE OF THE PROBLEM; PART II. GENERAL ASPECTS OF THE PHOTO APPEARANCE OF CROPS, by Clyde F. Kohn. Technical rept. no. 3 on Contract N7onr-45005. Dec 52, 47p. 24 refs. ATI-206 337.
Order from LC mi$3.30, ph$7.80 PB 144 692

One major problem in the use of aerial photographs in the study of crop distribution is the lack of keys for the identification of farm crops. This monograph is directed to the development of such keys. The interpretation of photographs used in the development of the keys was based on principles laid down in recent studies.

Northwestern U., Evanston, Ill.
AS ESSAY KEY FOR THE PHOTO IDENTIFICATION OF FARM CROPS AT SEVERAL INTERVALS DURING THE GROWING SEASON IN NORTHERN ILLINOIS. PART III. PHOTO APPEARANCE OF HAY FIELDS, by Clyde F. Kohn and Marjorie Smith Goodman. Technical rept. no. 3 on Contract N7onr-

45005. July 53, 44p. AD-15 690.
Order from LC mi$3.30, ph$7.80 PB 144 693

An analysis was made of 23 hay fields scattered throughout a 13 1/2-sq mi area. The samples included hay in all possible associations with types of landforms, soils, and variations in farm practices. The fields may be identified easily and with accuracy. Hay fields have 2 characteristics in common with other crops in the research area. They are of the same size and form as fields of other crops, and the photo appearance of hay fields is not affected by variations in landforms and soils, and only slightly by variations in farm practices. The fields possess 5 characteristics which distinguish them from other crops on aerial photographs. The 2 cycles of growth through which hay passes are recorded on aerial photographs by a cyclic progression of tonal values. At each stage of growth, there are unique field markings (texture), tonal values, and objects associated with hay fields. The fields outnumber all other kinds of cultivated crops. Tones of hay fields during their early, middle, and late stages of growth register more darkly than any other group. There are no periodic limitations to the aerial photo identification of hay crops as there are to the identification of other crops in the research area. (See also PB 144 692)

Pennsylvania U., Philadelphia.
SUMMARY OF SCIENTIFIC RESULTS, by Lester E. Klimm. Rept. for 1 Dec 56-1 Dec 57 on Contract Nonr-551(01). 1 Dec 57. 7p. AD-148 211.
Order from LC mi$1.80, ph$1.80 PB 138 077

Descriptions and graphic compilations are presented of the following land-use map categories of Pennsylvania from 1:250,000-scale aerial photography: (1) the D-line method and the nearest-neighbor concept, (2) possible naval application of the D-line method, (3) multiple-category D-line analysis, (4) detailed analysis of a single dispersant having area, (5) the D-line method applied to distribution of points, and (6) the D-line method without counting or sampling the actual distribution. This approach provides a wide selection of actual distribution of categories for analysis of areal association in a state where landscapes vary from being simple to very complex.

Oceanography

Air Force Cambridge Research Center, Bedford, Mass.
SCIENTIFIC STUDIES AT FLETCHER'S ICE ISLAND, T-3 (1952-1955), VOLUME I, by Vivian Bushnell. Sep 59, 229p. 109 refs. Geophysical Research Papers no. 63; AFCRC-TR-59-232(1); AD-216 813.
Order from OTS $3.50 PB 161 289

Contents:
Geophysical studies in the Arctic Ocean by A. P. Crary and Norman Goldstein
Oceanographic observations by L. V. Worthington
The movement of ice in the Arctic Ocean by Irene M. Browne and A. P. Crary
Micropaleontology and lithology of arctic sediment cores by David B. Ericson and Gosta Wollin
Ecology of some arctic foraminifera by Keith E. Green
Marine biological work by John L. Mohr
Birds in the upper Arctic by Raymond A. Paynter, Jr.
Pelagic and benthic polychaetes of the Central Arctic Basin by George A. Knox
Epipelagic and under-ice amphipoda of the Central Arctic Basin by J. Laurens Barnard
Tritium observations by B. J. Giletti and J. L. Kulp
Oxygen isotope measurements on arctic cores by Wayne U. Ault

Marine Lab., U. of Miami, Coral Gables, Fla.
STRAITS OF FLORIDA: PHYSICAL AND CHEMICAL DATA MAY 1957 - NOVEMBER 1958, by M. P. Wennenkens, D. M. Dunlop and others. Rept. on National Science Foundation Grant G-5041 and Contract Nonr-840(01). Dec 58, 84p. Rept. 58-5.
Order from LC mi$4.80, ph$13.80 PB 144 746

This report contains hydrographic and G. E. K. data collected between May 1957 and November 1958. Sampling stations are shown on the accompanying charts. The positions of the sampling stations are determined from D. R. plots and radar fixes. Sampling was by means of Nansen reversing water bottles. Deep-sea reversing thermometers were used to determine temperature; at each station. The depths reported for sub-surface observations were calculated from measured wire angles and from unprotected reversing thermometers; accepted depths were determined by using the depth-ratio (Z/L) method as described in H. O. Publication No. 607.

Physics of the Atmosphere

Air Force Cambridge Research Center, Bedford, Mass.
A PRELIMINARY REPORT ON A BOUNDARY LAYER NUMERICAL EXPERIMENT, by Mariano A. Estoque. Oct 59, 36p. 31 refs. GRD Research notes no. 20; AFCRC-TN-59-462.
Order from OTS $1.00 PB 161 341

A mathematical model of the atmospheric boundary layer over a flat homogeneous terrain is presented. The model consists of two sublayers: a thin sublayer adjacent to the earth's surface in which the fluxes of momentum and heat are independent of height and an overlying transitional zone where frictional effects gradually decrease with height. The equations are integrated numerically to obtain the distributions of wind and temperature with height during a 24-hour period for a given set of initial and boundary conditions. The results indicate that the model is capable of predicting the diurnal wind and temperature variations which are observed over flat homogeneous terrain. (Author)

[Army] Signal [Research and Development Lab.] Fort Monmouth, N. J.
STUDY OF SINGLE STATION ATMOSPHERIC

SOUNDING SYSTEMS, VOLUME II, by Howard Davis and Seymour S. Shefter. 17 June 52, declassified 8 Sep 54. 116p. Technical memo. no. M-1453; ATI-175 097.
Order from LC mi$6.00, ph$18.30 PB 144 649

The investigation of meteorological, electronic, and other applicable instrumentation techniques to be ultimately applied to atmospheric sounding equipments included the determination of the capabilities of known equipments. In Volume I, the theoretical capabilities of a number of equipments were analyzed and it was indicated that the rawin, remitter, and radar systems were superior to the other systems. A number of flight tests were conducted to determine whether the equations derived in Volume I contained all the factors essential to a determination of the equipment accuracy, and to determine the correctness of the various system errors assumed.

Naval Research Lab., Washington, D. C.
ROCKET RESEARCH REPORT NO. 29. THE VIKING 10 FIRINGS, by Milton W. Rosen and James M. Bridger. Interim rept. 5 May 55, 39p. 6 refs. NRL Rept. 4513.
Order from LC mi$3.00, ph$6.30 PB 145 038

The tenth Viking rocket, launched at White Sands Proving Ground, New Mexico, on May 7, 1954, carried a payload of 675 pounds to an altitude of 136 miles. At the first attempt to launch this rocket on June 30, 1953 an explosion occurred in the combustion chamber The repaired rocket was modified to include redesigned control systems which were being prepared for the new series of rockets beginning with Viking 11, and the ground equipment was redesigned and rebuilt. On the second flight attempt, the rocket performed well; there was some improvement in propellant loading, but there was a significant loss in peak altitude because of an excess of oxygen at burnout. The attitude control of the rocket was much better than in previous flights, and research equipment in the rocket operated properly; important data were obtained on the structure and composition of the ionosphere and on aerodynamic heating. Telemetering performance was excellent; a continuous record from takeoff to blowoff, at 474.3 seconds, was obtained. The rocket was tracked by radar from 27 seconds to 495 seconds, and by Askania theodolites for 102 seconds, and doppler data were obtained for 475 seconds. Trajectories, obtained from data provided by rocket-borne and range instrumentation, are compared in Appendix A. (Author)

Naval Research Lab., Washington, D. C.
THE USE OF HIGH-ALTITUDE ROCKETS FOR SCIENTIFIC INVESTIGATIONS: AN ANNOTATED BIBLIOGRAPHY, by Mildred Benton. Oct 59, 132p. 965 refs. Bibliography no. 16.
Order from OTS $0.50 PB 151 805

The growth and development of upper-atmosphere investigation by means of rockets is delineated in the periodical articles and technical reports referenced and annotated in this bibliography. Both domestic and foreign literature is included. The period covered is 1946 - June 1959. References are listed chronologically by author or issuing agency. An author index and a subject index are included. For periodical references, the normal form of entry is author, title, and journal, volume, pagination, and date, followed by a brief annotation or abstract. The form of entry for books is author, title, pagination, place of publication, publisher, and year. This sequence is also followed in citing articles in Proceedings of meetings, symposia and conferences. Research reports are reported in a similar manner except that place of publication follows the corporate author. The report number is also included following the date of publication, as well as the contract number, for sake of convenience in ordering or borrowing. The majority of references have been examined. When examination was not possible, due to non-availability of the publication, entries located in abstracting journals were used, or the statement "not examined" included.

ENGINEERING

Aeronautical Engineering

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
RECALIBRATION PROCEDURE FOR OXYGEN REGULATOR TEST STAND CALIBRATOR (NATIONAL INSTRUMENT LABORATORY CALIBRATOR) by James E. P. Davis. Rept. on In Service Test Apparatus. Aug 59, 17p. 1 ref. WADC Technical note 59-275.
Order from OTS $0.50 PB 161 334

This report gives a detailed description of the apparatus used to recalibrate an oxygen regulator test stand calibrator. It also provides an accurate system for data processing and recording which gives a final calibration accuracy of ±0.5%. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
THE ESTIMATION OF SHORT-TIME FLIGHT PATHS FOR INTERCEPTION DASHES, by Ray Holland, Jr. (New Mexico Military Inst.) Nov 59, 35p. AFMDC-TN-59-33.
Order from LC mi$3.00, ph$6.30 PB 144 596

A method to systematize the selection of a short-time flight path is presented. It is intended to be used as the first approximation in an iterative variational computation for determining a true minimum time path for interception dashes. The method applies to an aircraft already airborne flying in a short time from specified initial values of horizontal position x_o, altitude y_o, and velocity v_o to specified destination values of horizontal position x_n and altitude y_n, remaining at all times in a single vertical plane. (Author)

Aircraft Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ENVIRONMENTAL ASPECTS OF SONIC FATIGUE,

by Orville R. Rogers and Robert F. Cook. Rept. on Aeroelasticity, Vibration and Noise. Feb 57, 19p. WADC Technical note 57-68; AD-118 072.
Order from LC mi$2.40, ph$3.30 PB 144 802

Equipment and aircraft structures as presently designed are not always adequate to withstand the high intensity noise produced by modern powerplants used in military aircraft. The methods presently used to test equipment and structure do not include testing in intense noise. The purpose of this report is to consolidate available noise data in a useable form to determine methods of testing equipment and structure in noise. As a result of this study requirements for noise test equipment are more closely defined. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
ARC WELDING OF HIGH-STRENGTH STEELS FOR AIRCRAFT AND MISSILE STRUCTURES, by J. T. Niemann, R. P. Sopher, and P. J. Rieppel. 31 July 59, 45p. 13 refs. DMIC memo. 27; AD-220 519.
Order from OTS $0.50 PB 161 177

High-strength steels are being used in many aircraft and missile applications because of their good mechanical properties at room temperature and up to 1000 F. The steels in this category include hot-work die steels and martensitic and precipitation-hardening stainless steels. In addition, there is considerable interest in low-alloy hardenable steels which have room-temperature yield strengths in excess of 200,00 psi. One of the important considerations in selecting these steels for a particular application is their ability to be fabricated by welding. For the past several months, the Defense Metals Information Center has been collecting information on welding the high-strength steels. This report presents the data now available on arc welding. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
TITANIUM FABRICATION AND RELIABILITY PROBLEMS IN AIRCRAFT, by W. Stuart Lyman, C. T. Olofson, and A. M. Federico (North American Aviation, Inc.) 4 Sep 59, 32p. 20 refs. DMIC memo. 33; AD-226 589.
Order from OTS $0.50 PB 161 183

Presented at the Western Metal Congress in Los Angeles, Calif., 19 Mar 59.

This memorandum is intended to be a brief, up-to-date summary of fabrication and reliability problems associated with titanium. Most of the available information is on fabrication; little has been published about reliability. A selected bibliography at the end of the memoranudm lists 20 reports and publications related to titanium fabrication and (to a very slight extent) reliability. The memorandum itself briefly reviews the subject in four quick steps: (1) Metallurgical background, (2) Reliability of incoming material, (3) Shop experiences, and (4) Service reliability. (Author)

deFlorez Co., Inc., Englewood Cliffs, N. J.
THE APPLICATION OF POINT LIGHT SOURCE TECHNIQUES TO A BREAKOUT LANDING ATTACHMENT FOR A TWIN-ENGINE INSTRUMENT TRAINER. Rept. on Contract Nonr-1628(00). Mar 59, 60p. 7 refs. Technical rept. NAVTRADEVCEN-1628-2; AD-227 558.
Order from LC mi$3.60, ph$9.30 PB 144 452

This report describes the results of a study to determine if a satisfactory visual presentation can be obtained with point light source techniques for a low ceiling, poor visibility landing training attachment for a twin-engine instrument trainer. The scope and important elements of the problem were determined through interviews with pilots as well as from the requirements of the contract specification. A very promising point source projection system has been devised for use as a low ceiling, poor visibility landing training attachment for a twin-engine instrument trainer. The techniques employed to simulate atmospheric conditions which limit visibility (fog, haze, rain and snow) have been proved successful in a mock-up of limited scope. It is recommended that other aspects of the proposed system be evaluated through the experiments described.

deFlorez Co., Inc., Englewood Cliffs, N. J.
THE APPLICATION OF POINT SOURCE PROJECTION TECHNIQUES TO HELICOPTER LOW-ALTITUDE NAVIGATION TRAINING. Rept. on Contract Nonr-1628(00). Mar 59, 49p. 8 refs. Technical rept. NAVTRADEVCEN-1628-3.
Order from LC mi$3.30, ph$7.80 PB 144 453

This report describes the results of a study to determine if a satisfactory visual presentation can be obtained with point light source techniques for application to a helicopter low altitude navigational trainer. The scope and the important elements of the problem were determined through interviews with pilots as well as from the requirements of the contract specification. A very promising point source projection system has been devised for use in helicopter low altitude navigational training. It is recommended that this system be evaluated through the experiments described. (See also PB 144 452)

DeFlorez Co., Inc., Englewood Cliffs, N. J.
THE APPLICATION OF POINT SOURCE PROJECTION TECHNIQUES TO LOW ALTITUDE-HIGH SPEED NAVIGATION TRAINING. Rept. on Contract Nonr-1628(00). Apr 59, 49p. 8 refs. Technical rept. NAVTRADEVCEN-1628-4.
Order from LC mi$3.30, ph$7.80 PB 144 454

This report describes the results of an investigation to determine if a satisfactory visual presentation can be obtained with point light source techniques for application to a low altitude-high speed navigation trainer. It includes an analysis of the training task to determine the skills to be developed and the cues required for its performance. A very promising point source projection system has been devised for use in low altitude-high speed navigation training. It is recommended that this system be evaluated through the experiments described. (See also PB 144 453)

Flight Control Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
THE INFLUENCE OF GEOMETRY PARAMETERS UPON LAG ERROR IN AIRBORNE PRESSURE MEASURING SYSTEMS, by J. P. Lamb, Jr. July 57, 53p. 15 refs. WADC Technical rept. 57-351; AD-130 790.
Order from LC mi$3.60, ph$9.30 PB 144 530

The general nature of the lag problem in airborne pressure measuring systems is discussed. It is concluded that variations in system geometry offer the most promise in improving response. The remainder of the report is given to a theoretical examination of various geometry parameters and to an evaluation (utilizing both theoretical and experimental methods) of their effect upon lag error. Techniques for computing lag error in any system are presented. Theory and experiment are shown to be in agreement for the case of laminar flow. Evidence of transitional flow is also presented. Based upon the results of the study, specific dimensions for tubing lines and pitot-static tube chambers are recommended for use in the static pressure systems of high performance aircraft. (Author)

General Electric Co. [Schenectady, N. Y.]
ELECTROLUMINESCENT LIGHTING OF AIRCRAFT INSTRUMENTS, by John J. Fraizer. Rept. on Contract AF 33(616)5277. Sep 58, 154p. 13 refs. WADC Technical rept. 58-510; AD-202 504.
Order from LC mi$7.50, ph$24.30 PB 144 902

One phase of the report is the results of environmental tests applied to 5 manufacturers' lamps. Included are temperature, humidity, radio noise, voltage, and frequency tests. The data has been evaluated and analytical relationships have been developed. The second phase of the report is the application of electroluminescence to lighting various aircraft instruments. The instruments lighted included tachometers, flowmeters, voltmeters, and two vertical tape devices. Specific problems encountered were bringing power to pointer lamps on a low torque indicators, lighting a cyclometer register, and lighting vertical tapes. (Author)

Lear, Inc. [Grand Rapids, Mich.]
WHOLE PANEL STUDY AND DEVELOPMENT. SUMMARY REPORT 1957-1958. Rept. for 1 July 57-30 June 58 on Control-Display Integration Program, Contract AF 33(616)5167. Rev. Mar 59, 290p. 30 refs. Lear Engineering rept. 1289-1; WADC Technical rept. 58-447; AD-155 815.
Order from LC mi$11.10, ph$44.10 PB 144 543

The primary objective of the program was advancement of the state of the art of instrument panel and cockpit design. The cockpits were designed for classes of vehicles rather than specific Air Force weapons systems of the future. The pilot-manager concept, which was conceived during this program, is explained. Two cockpits, called the Mark II and Mark III, were delivered to the Air Force. The instrumentation and layouts of these cockpits are described. Also presented is an enumeration of individual items studied which have been selected for further study by the Air Force and airframe manufacturers. (Author)

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A REVIEW OF THE AIR FORCE MATERIALS RESEARCH AND DEVELOPMENT PROGRAM, by Helen H. Maxwell. Rept for 1 July 58-30 June 59. Nov 59, 169p. WADC Technical rept. 53-373, Supplement 6.
Order from OTS $3.00 PB 111 648 (sup. 5)

Two hundred and twelve (212) technical reports and technical notes written during the period 1 July 1958-30 June 1959 are abstracted herein. These reports cover the following general areas of research: adhesives, biochemistry, electronic materials, materials physics, metallurgy, petroleum products, plastics, protective treatments, rubber and textiles. A numerical index, contractor index and an investigator index of all the technical reports and technical notes issued during the period March 1923 - June 1959 are also provided. (Author) (See also PB 111 648 S4)

Midwest Research Inst., Kansas City, Mo.
DEVELOPMENT OF A FATIGUE TESTING APPARATUS FOR TESTING HONEYCOMB SANDWICH STRUCTURAL PANELS IN SERVICE-SIMULATED SONIC FATIGUE, by Edmond F. E. Zeijdel and William H. Ashley. Rept. for 15 Apr 57-15 Apr 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5172. Sep 59, 40p. 8 refs. WADC Technical rept. 59-231.
Order from OTS $1.00 PB 161 317

Theoretical and experimental investigations for the development of a fatigue testing apparatus for testing honeycomb sandwich panels in service-simulated sonic fatigue are described in this report. These investigations indicate the need of a 200,000-v. AC generator to simulate electrostatic fields of approximately 400,000 v/cm. In addition, it is indicated that the medium surrounding the test specimen must be changed to prevent corona discharge. For this purpose sulfur hexafluoride at 9 to 10 atmospheres may be utilized. The design of a 200,000-v. AC generator is complicated and expensive. An alternative procedure to accomplish the same objectives is therefore recommended. (Author)

New York U. Coll. of Engineering, N. Y.
HANDLING AIR CONTAMINANTS RESULTING FROM A CLOSED ECOLOGICAL SYSTEM, by Gerald Palevsky. Progress rept. on the Engineering Biotechnology of Handling Wastes Resulting from a Closed Ecological System, Contract AF 18(603)71. July 57, 18p. 28 refs. AFOSR-TN-58-269; AD-154 170.
Order from LC mi$2.40, ph$3.30 PB 137 797

Consideration is given to the control of temperature, humidity, air motion, foreign matter, microorganisms, air conditioning, and water supply in creating an acceptable environment for humans working in a closed ecological system. Each factor is considered in relation to the others.

North American Aviation, Inc., Columbus, Ohio.
DOD HIGH STRENGTH TITANIUM ALLOY SHEET RESEARCH PROGRAM, by A. M. Federico and P. Maynard. Progress rept. no. 5, 1 July-30 Sep 58, on Contract NOas 57-785-d. 31 Oct 58, 32p. Rept. no. NA57H-527-5; AD-207 900.
Order from LC mi$3.00, ph$6.30 PB 137 866

Preliminary fusion and resistance welding tests are in progress on small quantities of 4Al-3Mo-1V and 16V-2 1/2 Al received.

Oklahoma U. Research Inst., Norman.
ANALYSIS DESIGN STUDY OF A HIGH CAPACITY LIGHTWEIGHT COMPRESSOR, by A. C. Buckingham, Stan H. Lowy and B. V. Ketcham. Final rept. on Contract DA 44-177-tc-502. 9 Feb 59, 156p. 16 refs. AD-208 315.
Order from OTS $3.00 PB 161 347

This design study has established the feasibility of a vane type oscillating compressor suitable for various applications where unit weight is a major consideration. In a comparative analysis with the best available lightweight centrifugal compressor, the vane type unit for a given pressure ratio and mass flow was far superior in displacement and weight savings. The comparison was made on the basis of compressor weight per atmosphere pressure rise per mass flow. Compared to the sliding vane, positive displacement compressor with discharge pressures up to 9 1/2 atmospheres and capacities to 2000 cubic feet per minute, the vane type oscillating compressor still maintains a large weight advantage. This weight advantage increases still further when comparison is made with impeller or gear type positive displacement compressors.

Princeton U., N. J.
EFFECT OF FLAPPING HINGE RESTRAINT AND OFFSET ON THE STABILITY AND CONTROL OF UNDUCTED STAND-ON HELICOPTERS, by Peter Hampton. Rept. on Contract DA 44-177-tc-392. May 59, 138p. 6 refs. Rept. no. 462; AD-227 157.
Order from LC mi$6.90, ph$21.30 PB 144 816

This report deals with the longitudinal stability and control of unducted stand-on helicopters. The effect is investigated of varying the physical characteristics of the rotor system of a typical machine of this type. The rotor, which was presumed to be rigid on the original machine, is now considered as a rotor of the flapping type, modified by: (a) varying the spring restraint of a flapping hinge mounted at the rotor hub. (b) varying the offset from the rotor hub of a free flapping hinge. In addition the induced velocity through the rotor is assumed to have a linear longitudinal variation. Theoretical stability derivatives are obtained for these cases and the resulting stability and control discussed. (Author)

Princeton U., N. J.
LONGITUDINAL STABILITY AND CONTROL OF A DUCTED-ROTOR FLYING PLATFORM, by Joseph J. Traybar. Rept. on Contract DA 44-177-tc-392. May 59, 144p. 9 refs. Rept. no. 464; AD-227 158.
Order from LC mi$7.20, ph$22.80 PB 144 815

An analysis is presented for the prediction of the longitudinal stability and control characteristics of a ducted-rotor flying platform. The stability characteristics of this vehicle are corroborated by the investigations and exhibited rather clearly by various stability diagrams. Artificial stabilization is discussed and can be used to stabilize certain configurations. The predictions of excessive trim requirements and large tilt angles for forward flight are substantiated. Also, the effects of changing duct design and vertical center of gravity location on the stability derivatives are discussed, and material is presented to reflect the degree to which these changes can be used as aids in stabilizing the platform. (Author)

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
PRESSURE DISTRIBUTION IN TRANSONIC FLOW OF RIBBON AND GUIDE SURFACE PARACHUTE MODELS, by H. G. Heinrich, J. G. Ballinger, and P. E. Ryan. Rept. on Contract AF 33(616)3755. Feb 59, 96p. WADC Technical note 59-32; AD-210 257.
Order from LC mi$5.40, ph$15.30 PB 145 031

The pressure distributions over the canopy of two rigid parachute models were made in a speed range of free stream MACH numbers from .6 to 1.2. Internal and external pressure distributions were conducted on a guide surface and a ribbon model parachute. The results of these data will be used in determining an accurate method of calculating the heat transfer throughout a parachute canopy during descent. Presented are details pertaining to the test methods and equipment used to obtain the experimental data. (Author)

Servomechanisms Lab., Mass. Inst. of Tech., Cambridge.
SIMULATION OF AIRCRAFT, by Mark E. Connelly. Rept. on Contracts N5ori-07895 and N61339-45. Feb 58, reprinted May 59, 206p. Technical rept. NAVTRADEVCEN 7591-R-1.
Order from LC mi$9.30, ph$31.80 PB 144 640

This report is an outgrowth of a one-year study of the equations of motion and the computing techniques used in the aerodynamic computer section of Operational Flight Trainers. One of the objectives of the study was to standardize and simplify, insofar as possible, the mathematical model used to represent an aircraft in flight. In this connection, an extensive analysis of axis systems, basic dynamics, and aerodynamic coefficients was carried out. Digital and analog simulation studies were employed to determine allowable simplifications in the equations of motion. The results of this work are summarized in the following report. Although the emphasis is on flight simulators used for training purposes, the material presented is generally applicable to the entire field of flight simulation. (Author)

Chemical Engineering

Army Engineer Research and Development Lab., Fort Belvoir, Va.
MOBILE LIQUID-OXYGEN PLANT, by Edward F. Kelley. Rept. for Jan 46-Jan 58 on Liquid Oxygen Plants, Storage, and Distribution Equipment (10-100 Tons per Day). 23 June 58, 131p. Technical rept. 1532-TR.
Order from LC mi$6.90, ph$21.30 PB 144 730

The report concludes that: a. The application of the Kapitza principles of liquefying air for the production of liquid oxygen, using the low-pressure cycle and turboexpander, has been accomplished to meet the military requirements for mobile, van-mounted, liquid-oxygen generators. b. The end result is a reduction in weight per ton of product, compared with industrial machinery, in the order of 75 percent. c. Development work should be continued. Development work should be pursed toward the end of transferring liquid oxygen by static pressure in lieu of the pump.

Westinghouse Research Labs., Pittsburgh, Pa.
ELECTRICAL CLEANUP OF GASES, by J. H. Carmichael. Progress and final rept. for Mar 54-Mar 59 on Contract AF 18(600)1049. 1 May 59, 6p. 5 refs. Research rept. 71F191-R20; AFOSR TR-59-80.
Order from LC mi$1.80, ph$1.80 PB 142 947

A study of the mechanism for trapping gases as ions on metal surfaces has been made. In order to separate ionic pumping from chemical absorption, only rare gases were used. In these studies it was found that the re-emission of these gases from the surface was playing an important role. A study of the ionic pumping and spontaneous re-emission of these gases has contributed considerably in an understanding of the pumping characteristics of ion pumps and ionization gauges.

Civil Engineering

Bureau of Yards and Docks, Washington, D. C.
HOUSING ADMINISTRATION. 5 Aug 57, 433p. Technical pub. NAVDOCKS TP-Ad-3, Rev.; BUDOCKSINST 11101.29A.
Order from LC mi$11.10, ph$66.60 PB 144 513

This Technical Publication is intended for the guidance of personnel concerned with the procurement, administration, maintenance, and operation of housing facilities and programs under the jurisdiction of the Department of the Navy. It cites the authorities, powers, and responsibilities under which Navy housing facilities and programs are administered. It prescribes the procedures to be followed to obtain effective control and administration of housing, gives technical guidance and counsel, and sets out the considerations to be taken into account in making decisions. It seeks to bring about efficiency, standardization, and procedural uniformity in the administra-

policies on housing in general, the methods used to classify housing, and the organizational provisions made by the Navy to handle housing matters. Chapter 2 is devoted to public quarters. It discusses general aspects of public quarters administration, including designation, assignment, occupancy, equipping, and accountability. Chapter 3 deals with Title VIII (Wherry) housing. It sets forth policies, legislation, regulations and authorities; procedures; and the respective responsibilities of the Department of the Navy, the Federal Housing Administration, the project sponsor, and the mortgage lender. Chapter 4 discusses administration rental housing facilities that are maintained and operated directly by the Department of the Navy.

[Defense Atomic Support Agency] Washington, D. C.
BLAST LOADING ON DOMES AND ARCHES, by Ferd E. Anderson, Jr. 21 July 58, 12p. 8 refs. AFSWP-522.
Order from LC mi$2.40, ph$3.30 PB 144 501

Dome and arch structural configurations offer promise in the design of economical above-ground protective structures up to incident peak overpressures of about 100 psi. Studies of the response of such structures to blast loads are underway but are somewhat hindered by the lack of information on the blast loading likely to occur. The purpose of this report is to present an analysis of dome and arch loading derived from shock tube data, wind tunnel data, and data collected from a nulcear weapons test, in Nevada in 1957

Electrical and Electronic Engineering

Air Force Missile Test Center, Patrick AFB, Fla.
TELEMETRY AUTOMATIC REDUCTION EQUIPMENT TARE II, by E. W. Earle, J. T. Winkler and W. H. Butler. Final engineering rept. 5 Aug 58, 82p. AFMTC-TR-58-17; AD-134 267.
Order from LC mi$4.80, ph$13.80 PB 144 441

TARE II is essentially an automatic data reduction system designed to convert raw telemetry data (FM, PDM or PAM/FM) into digital form. Once in digital form, the data is then separated, reduced, linearized and tabulated at a high rate of speed by an automatic computer. The signal input to the system is on magnetic tape previously recorded from the range telemetry stations. The digitized output of the system is recorded on six tract magnetic tape in proper format for computer insertion. In addition to missile flight function information; computer formatting information and periodic time samplings are also digitized and recorded on the output tape.

Andersen Labs., Inc., West Hartford, Conn.
TAPPED CARRIER TYPE ACOUSTIC DELAY LINE. Final rept. for 15 Oct 56-30 Oct 58 on Contract AF 19(604)2146. [1958] 35p. 1 ref. AFCRC-TR-58-

190; AD-228 086
Order from LC mi$3.00, ph$6.30 PB 144 417

Theoretical and experimental investigations have been conducted on several methods of accomplishing a tapped, carrier type acoustic delay line having 32 equally spaced taps, a total storage capacity of 1200 digits with a counting rate in excess of 800,000 digits per second. The various methods studied fall into the following general categories: (a) "Branch" tapping wherein the acoustic beam strikes an improperly matched boundary which is at an angle to the direction of propagation, part of the acoustic energy continuing through the boundary and part being reflected at an angle of reflection equal to the angle of incidence; one branch being terminated at an output tap transducer and the other continuing down the line to the next tap. (b)"Series" tapping, wherein the transducers for each tap are inserted directly in the acoustic beam normal to the direction of propagation. (c) Optical tapping, wherein the strains produced in the fused quartz by the acoustic beam are detected by the displacement or polarization of a light beam passing at right angles to the direction of propagation through the thickness of the quartz slab. (d) Parallel acoustic beams wherein each tap is arrived at by a separate acoustic path and has a separate input as well as separate output transducers. After some preliminary study, this method was abandoned since it does not strictly fulfill the objectives of the Contract as defined under Item 1. (e) Tapping along the path of a Raleigh type surface wave.

Battelle Memorial Inst., Columbus, Ohio.
COMPONENT EVALUATION AND SPECIFICATION ENGINEERING. TEST DATA ON TASK XV. RESISTOR, VARIABLE, SUBMINIATURE. VOL. I OF II. Data taken July 54-May 55, Contract DA 36-039-sc-63136. [1955] 194p. AD-114 851.
Order from LC mi$8.70, ph$30.30 PB 137 806

Battelle Memorial Inst., Columbus, Ohio.
THE FURTHER DEVELOPMENT AND EVALUATION OF AURAL READING DEVICES FOR THE BLIND, by John S. Abma, Lois L. Huffman, and Lawrence J. Mason. Summary rept. for 1 July 58-30 June 59 on Contract V1005 M-1961; Continuation of Contract V1005 M-1261. 30 June 59, 83p. 4 refs.
Order from LC mi$4.80, ph$13.80 PB 144 748

Experience in using five prototype aural reading devices indicated the desirability of a number of mechanical and electronic modifications. Changes were made and these alterations resulted in a reliable instrument that produces the letter code much more clearly than did the first models. Evaluation activities included the investigation of various training techniques.

Bendix Aviation Corp., Southfield, Mich.
DEVELOPMENT OF MILLIMETER-WAVE BACKWARD-WAVE OSCILLATOR TUBES; 35-75 KMC, by M. I. Antoniou, F. E. Clifford, and A. G. Piefer. Rept. for 15 Aug 57-14 Nov 58 on Electronic Tubes and Transistors, Contract AF 33(600)35830. Sep 59, 131p. 5 refs. WADC Technical rept. 59-401.
Order from OTS $2.75 PB 161 351

The development program included (1) analytical and experimental work on the formation and focusing of variable voltage electron beams, and on the optimum design of r-f interaction structures, (2) design, fabrication and testing of experimental tubes, and (3) delivery of three Q-band and three V-band tubes. One of the objectives in the electron gun work was to minimize the lens effects normally present in an ordinary electron gun system. The analytical and experimental work on the formation of variable voltage electron beams concentrated on the three-anode gun system. The study of the r-f circuit concentrated on the geometries of ridge-ladder and fin type structures. A metal envelope mechanical design was used for the developmental model tubes. Tests on operating tubes included measurements of frequency as a function of tuning voltage and measurements of output power. The results of the tests are given in considerable detail. One Q-band tube produced more than 25 milliwatts of output power over a portion of the band.

Bliley Electric Co., Erie, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON 5000.000 kc/s 5th OVERTONE HIGH PRECISION CRYSTAL UNITS, by J. M. Wolfskill and R. T. Schlaudecker. Completion rept. for step 1 on Contract DA 36-039-sc-54697. Nov 57, 55p. AD-158 622.
Order from LC mi$3.60, ph$9.30 PB 137 422

This report presents the process manual which was developed for the production of 5000.000 kc high precision quartz crystal units. The units produced have a short term stability of 1 part in 10^9, aging of less than 1 part in 10^8 per week and a temperature coefficient of less than 1 part in 10^7 per degree centigrade. The units use "A" cut, fifth overtone, plano-convex, polished crystal discs, wire mounted in T 5 1/2 glass envelopes. This report includes a copy of the specification governing these units, a material list, a list of the special equipment used (with pictures of the more important pieces), a discussion of the difficulties encountered, a table of yields attained and a listing of the technical personnel who performed this work. One of the most difficult phases of the program was the consistent failure of equipment to meet the exacting demands. In particular this was true during those operations which required accurate comparisons to less than 1 part in 10^9. While this was finally achieved, the only reference frequency source available for practical checking of the production quantity of these units was a preproduction sample unit which had actually been produced under this same contract. This unit has been in continuous operation since early in April of this year, 1957, and careful periodic evaluation has proved that it is still very acceptable as a reference standard. (Author)

Case Inst. of Tech., Cleveland, Ohio.
STUDY OF APERTURE FIELDS IN THE DIFFRACTION BY A SLIT, by Hwei-Piao Hsu. Scientific rept. no. 5 on Contract AF 19(604)3887. 31 July 59, 60p. 14 refs. AFCRC-TN-59-585.
Order from LC mi$3.60, ph$9.30 PB 144 582

Several approximate techniques of solution for the aperture fields in the diffraction by a slit are discussed and compared with the rigorous solution. The

latter was obtained from the Mathieu function series; an extension to the available tables being required. None of the approximate techniques are completely satisfactory. Experimental measurements by means of a parallel-plate device of the field distribution over the aperture in slits of 3.5 λ, 3λ, 2.21λ, 1.27λ width were performed and discussed, and satisfactory comparison with the exact solution for the cases of 1.27 λ and 2.21λ width obtained. The exact solution of diffraction by a slit due to a line source is also presented. (Author)

Colorado U. Engineering Experiment Station, Boulder.
ATTAINABLE CHARACTERISTICS FOR A SPANATRON TUBE, by J. C. Twombly. Technical rept. no. 7 (Final) on Contract Nonr-1147(01). 30 Apr 58, 22p. 2 refs.
Order from LC mi$2.70, ph$4.80 PB 138 571

Using performance of a cyclotron resonance microwave detector in a uniform magnetic field as a reference, performance of such a tube in the non-uniform field required for wide-band spectrum analysis is presented. The relationship between threshold sensitivity and spectrum width per channel is demonstrated, and experimental verification is cited. Likewise, the effect of channel width on the shape of the frequency response curve for that channel is developed, along with factors governing the choice of this channel width. Representative oscillograms are included for illustration.

Compagnie Generale de Telegraphie Sans Fil (France).
A NEW TYPE OF ENDFIRE ANTENNA "SAUCISSON ANTENNA", by Erich Spitz. Final technical rept. no. 1 for 1 May-30 Sep 59 on Contract DA 91-591-EUC-1128. 1959, 28p.
Order from LC mi$2.70, ph$4.80 PB 144 459

The report describes the first phase of development a new type of an endfire antenna, called "Saucisson Antenna". It consists essentially of a twin-line surrounded by a helix. The antenna should work in the range 350-600 Mc/s. Scale models working in the S band (2.600-4.500 Mc/s) have been realized and investigated. The best one is described and experimental results are given. (Author)

Compagnie Generale de Telegraphie Sans Fil (France).
RESEARCH ON AIR TO GROUND SCATTER (I) [AND] SUPERGAIN AND VOLUMETRIC ANTENNAS (II), by J. Robieux and E. Spitz. Technical (Final) rept. on Contract AF 61(514)1150, part of complete final rept. on Contract AF 61(052)102. 15 June 59, 27p. AFCRC-TR-59-193.
Order from LC mi$2.70, ph$4.80 PB 144 597

An antenna, radiating in the rear direction at 220 Mc, designed to be mounted on a C-54 plane, was investigated. The antenna consisting of four corrugated surfaces was built in reduced scale and pattern and gain is given. Some experiments with closely coupled sources are given. A built supergain broadside antenna is described. (Author)

Computation Lab., Harvard U., Cambridge, Mass.
COMPUTATION OF FM COCHANNEL INTERFERENCE, by Howard Aiken. Rept. on Design and Operation of Digital Calculating Machinery, Contract AF 19(604)4947. 1 July 59, 27p. 8 refs. Scientific rept. no. AF-54; AFCRC-TN-59-778.
Order from LC mi$2.70, ph$4.80 PB 144 973

Corning Glass Works, N. Y.
CAPACITORS, HIGH KVA TRANSMITTING TYPES, GLASS DIELECTRIC. Final rept. on Contract NObsr-57558. 1 Apr 55, 63p.
Order from LC mi$3.90, ph$10.80 PB 145 025

This final report on the development of high power transmitting capacitors with glass dielectric contains a short summary of the background of the development. Salient elements of design of these capacitors are noted. Data on final samples submitted for evaluation, and methods of their construction, are presented.

Cruft Lab., Harvard U., Cambridge, Mass.
QUARTERLY SCIENTIFIC REPORT NO. 20. Rept. for 1 Apr-1 July 58 on Contract AF 19(604)786. 1 July 58, 4p. AFCRC-TN-58-364; AD-160 808.
Order from LC mi$1.80, ph$1.80 PB 137 891

Brief summaries of work on theory of antennas coupled to two-wire line; the problem of electrical scanning of dipole arrays; scattering from a reactively loaded linear antenna; scattering from slotted cylinders; and the scattering of plane waves by obstacles.

Diamond Ordnance Fuze Labs., Washington, D. C.
BIREFRINGENCE OF FERRITE TUBES IN CIRCULAR WAVEGUIDE, by N. Karayianis and J. C. Cacheris. 19 Aug 59, 24p. 3 refs. TR-651.
Order from LC mi$2.70, ph$4.80 PB 144 566

Birefringence of various ferrite configurations in circular waveguide over the frequency range 9.0 to 10.0 kMc. The use of ferrite tubes in circular waveguide as quarter-wave plates is feasible, dependent on a compromise between bandwidth and differential phase shift per unit length.

Diamond Ordnance Fuze Labs., Washington, D. C.
A TECHNIQUE FOR DESIGNING TRANSFORMERS TO MATCH BETWEEN TWO CIRCULAR WAVEGUIDES, by N. Karayianis. 28 Aug 59, 15p. 5 refs. TR-765; AD-229 091.
Order from LC mi$2.40, ph$3.30 PB 144 705

A simple method of designing transformers to match between two arbitrary impedance, circular waveguides is described, and an example given. The method combines a generalization of measurements made of tubes of Teflon in circular waveguide with the general knowledge concerning the nature of multistep transformers. The experimental results of the application of the technique to design a match between standard-size X-band circular guide and a complex dielectric-ferrite-loaded

reduced-size circular guide are included. The essential results are that the reflections after matching are more than 15 db down from the incident signal in the range 9.1 to 9.9 kmc, whereas before matching there was almost total reflection of the incident signal. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
TEST CIRCUITS FOR THE MEASUREMENT OF TRANSISTOR CURRENT-GAIN IN THE 0.1- TO 200-Mc FREQUENCY RANGE, by George N. Kambouris and Erwin Hirschmann. 15 June 59, 11p. 7 refs. TR-723; AD-219 810.
Order from LC mi$2.40, ph$3.30 PB 144 665

Tests sets were designed and constructed that permit accurate measurement of the magnitude of transistor current gain in both the common-emitter and common-base configurations over an extended frequency range (up to 200 Mc) and at various bias conditions. Components and techniques used and problems encountered are described. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
WIDE-BAND TRANSISTORIZED VIDEO AMPLIFIER, by Einar Naess. 30 June 59, 8p. TM-59-5.
Order from LC mi$1.80, ph$1.80 PB 144 710

The design and construction data are included of a miniaturized, wideband video amplifier utilizing 2N502 transistors. The final design occupies a volume of 0.7 cu in., weighs 0.5 oz, and operates with 0.2 watt, at 12 volts. It has a 65-db voltage gain, 60-Mc bandwidth, and one-volt output across a 1000-ohm impedance. (Author)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
PATTERN SYNTHESIS FOR ANTENNA ARRAYS ON CIRCULAR, ELLIPTICAL, AND SPHERICAL SURFACES, by R. H. DuHamel. Technical rept. no. 16 on Contract N6-ORI-71 Task XV. May 52, 103p. 60 refs. ATI-166 395.
Order from LC mi$5.70, ph$16.80 PB 144 814

A general method of pattern synthesis is presented for an array of antenna elements placed on a circle, an ellipse, a sphere, a spheroid and an ellipsoid. Since only the element pattern is required, the antenna elements may be dipoles or loops, either with or without a concentric reflecting surface, or slots. This method of pattern synthesis could be quite useful in the design of antenna systems for direction finding, radar, and other applications.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
PROOFS OF SOME NETWORK THEOREMS BY TOPOLOGICAL FORMULAS, by S. L. Hakimi and W. Mayeda. Interim technical rept. no. 11 on Contract DA 11-022-ORD-1983. 25 Sep 58, 25p. 4 refs.
Order from LC mi$2.70, ph$4.80 PB 138 574

In this report, some properties of network functions are deduced by means of topological formulas. The studies include the relationship between missing powers in polynomials in network functions and network geometry, Fialkow and Gerst coefficients conditions, and frequency and magnitude scaling. Although some of these results were previously known, we will show that they can also be obtained with simplicity using topological formulas.

Electronic Communications, Inc., Timonium, Md.
BROADBAND, STEERABLE LINEAR ARRAYS, by D. D. King, R. F. Packard, and R. K. Thomas. Scientific rept. no. 1 on Contract AF 19(604)5234. 7 Oct 59, 30p. AFCRC-TN-59-789.
Order from LC mi$2.70, ph$4.80 PB 144 598

Requirements for a broadband steerable linear antenna array are given. The limitations due to grating lobes of an equally spaced array are discussed. Several different unequally spaced arrays have been studied which have two advantages: (1) fewer elements for comparable beamwidth (2) grating lobes and minor lobes replaced by sidelobes of unequal amplitude and all less than the main beam. A scheme for controlling the cosine arguments in the radiation pattern formula is given which has resulted in the best pattern of this study.

Electronics Research Lab., U. of California, Berkeley
MODES IN LINEAR CIRCUITS AND LINEAR SAMPLED DATA SYSTEMS, by Charles A. Desoer. Rept. on Contract AF 18(600)1521. 27 July 59, 45p. 19 refs. Series no. 60, issue no. 224; AFOSR-TN-59-849.
Order from LC mi$3.30, ph$7.80 PB 144 493

The purpose of this paper is to develop the concept of modes in linear circuits. It is well known that the chapter on modes in lossless circuits or in conservative mechanical systems belongs naturally to any good text on the subject. The contribution of this paper is to show that provided a suitable point of view is taken, the concept of modes does apply indeed to any linear circuit: more precisely, it will be shown that it applies to any lossy or lossless, active or passive, reciprocal or nonreciprocal circuit. The importance of the mode concept lies in the fact that it allows one to consider a linear circuit as a whole, to break up its behavior as a sum of very simple patterns, and to visualize easily the effect of externally applied forces. Furthermore it provides a very informative description of the resonance phenomenon.

Federal Telecommunication Labs., Nutley, N. J.
LOW-LOSS COAXIAL CABLES. Final rept. for 1 Oct 55-30 Sep 56 on Contract DA 36-039-sc-70140. Feb 57, 77p. 3 refs. AD 134 895.
Order from LC mi$4.50, ph$12.30 PB 145 059

To improve the quality of polyethylene coaxial cables, theoretical changes in conductor designs and dielectric structure leading to lower loss are considered, particularly to reduce attenuation in the super-high-frequency (SHF) band. The principles of foaming polyethylene by decomposition of chemical additives

are described, and the effects on the dielectric properties are discussed.

Ferranti Electric, Inc., New York.
DEVELOPMENT OF AN ACOUSTIC DELAY LINE FOR DIGITAL STORAGE. Final rept. on Contract AF 19(604)3900. 8 July 59, 32p. 1 ref. AFCRC-TR-59-169.
Order from LC mi$3.00, ph$6.30 PB 144 442

The primary purpose of this work is to extend the region of the low temperature coefficient of delay. An additional object has been an evaluation of the reproducibility of the temperature coefficient, when similar materials, given identical treatment, are used to make several delay lines. Other important topics investigated are: adjustable tapped torsional lines, lines operating at a higher frequency, use of compensating materials to reduce overall temperature effects and establishment of a procedure whereby proper heat treatment of a material may be determined.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS by Douglas W. Robertson and S. N. Witt, Jr. Progress rept. no. 1, 16 Apr-15 July 56, on Contract DA 36-039-sc-71191. [1956] 46p. 4 refs.
Order from LC mi$3.30, ph$7.80 PB 138 498

Four units of extended frequency range have been constructed under the present contract for use with experimental bridge and substitution type CI Meters. These units complete a set of ten rheostats which exhibit phase angles of less that $\pm 11^{o}$ over a range of 30 to 200 ohms from 75 to 300 mc/sec.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by Douglas W. Robertson, S. N. Witt, Jr. and William R. Free. Progress rept. no. 3, 15 Oct 56-15 Jan 57, on Contract DA 36-039-sc-71191. [1957] 54p.
Order from LC mi$3.60, ph$9.30 PB 138 496

An experimental thermistor bridge power measuring system was assembled and tested. The results obtained from the experimental system indicate that a system of this type should be capable of measuring crystal power dissipations over the range of 0.5 to 4.0 mw with an accuracy of ± 5 percent. The experimental model of the coaxial Crystal Parameter Bridge was completed. Impedance matching within 15 percent for magnitude and 5 degrees for phase angle at drive levels as low as 0.5 mw have been obtained with the present unit. (See also PB 138 497)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by Douglas W. Robertson, S. N. Witt, Jr. and William R. Free. Progress rept. no. 4, 16 Jan-1 June 57, on Contract DA 36-039-sc-71191. [1957] 71p. 3 refs.
Order from LC mi$4.50, ph$12.30 PB 138 495

A prototype thermistor-bridge power meter for measuring the r-f power dissipated in VHF quartz crystals was constructed and tested. An experimental UHF capacitance bridge oscillator was constructed that displayed characteristics suitable for use with the coaxial bridge. Crystal controlled oscillations as high as 420 mc/sec were obtained with a modified version of this oscillator. (See also PB 138 496)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
STUDY OF THE EFFECTS OF PROCESSING TECHNIQUES AND MATERIALS ON AGING OF QUARTZ CRYSTAL UNITS, by Richard B. Belser. Quarterly rept. no. 5, 15 May-15 Aug 56, on Contract DA 36-039-sc-64613. [1956] 128p.
Order from LC mi$6.30, ph$19.80 PB 138 707

A glass-sealing lathe and a chamber for the simultaneous plating by evaporation of both faces of resonator blanks have been constructed.

Ionospharen-Institut Breisach (West Germany).
RESEARCH ON PULSE TRANSMISSION AT OBLIQUE IONOSPHERIC INCIDENCE, by Karl M. A. Bower. Annual summary rept. 1958/9 on Contract AF 61(052)129. 23 July 59, 13p. 1 refs. AFCRC-TN-59-770.
Order from LCmi$2.40, ph$3.30 PB 144 589

Description of apparatus for oblique incidence pulse experiments including amplitude recording. First results obtained between Germany and the US. (Author)

[ITT] Labs., Nutley, N. J.
LOW- AND VERY-LOW-FREQUENCY ANTENNA DATA. Final engineering rept. for May 56-Aug 57 on Contract Nonr-2148(00). Oct 57, 76p. 7 refs. AD-145 986.
Order from LC mi$4.50, ph$12.30 PB 137 694

The problems involved in applying helical top-loading techniques to large, high-power antennas for the VLF range were studied. Electrical design and performance parameters are calculated for a 15-kc antenna and a 1/10 scale model. Results indicate that it is feasible to erect a high tower on land with a large helix and capacitive load mounted on top. A typical 15-kc antenna would consist of a guyed fabricated steel tower 1700 ft high surmounted by a 150-ft helix and 150-ft capacitive load on top of the helix. The tower can be grounded and insulators can be omitted in the guy wires. The antenna feed line would be run up to the tower to the base of the helix. The helix would be made entirely of strong insulating material except for a few discretely placed metal members to strengthen the frame. Radiation efficiency of about

60% appears attainable. Voltage at the top of the antenna approaches 5 megavolts rms for 2 megawatts input. The resulting voltage gradients have a safety factor of about 3.5 on the breakdown strength of air. The Q is relatively high which limits the keying speed. Experiments on 1/10,000 scale models of the 15-kc structure indicated that directive arrays are feasible. Such arrays would simplify the problems of mechanical design, erection, and high voltage (since the power would be divided between several towers).

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSISTORIZED RELAY AMPLIFIER, by R. A. Bruns and J. H. Wilcher. Rept. on Contract DA 04-495-ORD-18. 2 Sep 58, 17p. 6 refs. Memo. no. 20-170; AD-207 045.
Order from LC mi$2.40, ph$3.30 PB 144 715

The development of a transistorized relay amplifier of superior performance to vacuum-tube type of amplifiers commonly used is described. The circuit was designed from an analytic approach utilizing matrices amenable to digital computer solution for the performance of a large amount of computations. The digital computer permitted a thorough survey of parameter studies and illustrates a powerful design method extendible to cirucits of greater complexity. Performance tests of the transistorized relay amplifier with the analog computer showed it to be superior to the vacuum-tube type in lower noise level, a smaller inactive zone, and much faster time response. (Author)

Johns Hopkins U., Baltimore, Md.
A THEORY OF NEARLY LINEAR SYSTEMS, by Francis H. Clauser. Rept. on Contract AF 49(638)496. [1959] 75p. AFOSR-TN-59-1133.
Order from LC mi$4.50, ph$12.30 PB 144 779

A theory is developed which permits the usual concepts of impedance and admittance to be applied to nonlinear systems, but the impedances and admittances now become matrices whose components give not only the response to the multiple frequencies that are present in nonlinear systems, but also the intercoupling of these frequencies as well. Numerous examples are used to show that the method can treat a wide variety of problems such as subharmonic and superharmonic resonance, oscillator lock-in, parametric amplification, superregeneration, rectification, modulation and the like. (Author)

Marathon Battery Co., Wausau, Wis.
INDUSTRIAL PREPAREDNESS STUDY ON PAPER LINED BATTERIES TYPE BA-270/U-XPL. by George H. Schroeder. Final technical rept. on Contract DA 36-039-sc-30270. Sep 57, 65p.
Order from LC mi$3.90, ph$10.80 PB 144 503

The equipment provided for the production of paper lined cells for battery BA-270/U-XPL is described. The more significant experimental work is recounted as well as the performance of batteries furnished the Signal Corps on several occasions. The batteries furnished as the third preproduction lot met the performance requirements. The contractual batteries were made and shipped. (Author)

Mauch Labs., Inc., Dayton, Ohio.
THE DEVELOPMENT OF A READING MACHINE FOR THE BLIND, by A. F. Emanuel and H. A. Mauch. Summary rept. for 12 Sep 58-30 June 59 on Contract V 1005 M-1943. 30 June 59, 8p.
Order from LC mi$1.80, ph$1.80 PB 144 749

A mechanical model of the human speech mechanism was built and evaluated in an effort to produce a speech-like, and more easily learned, output. This model was then abandoned because of its inherent limitations. Further efforts to produce a speech-like output results in the development of a collection of speech sounds (word fragments) which are capable of being used to construct artificial words closely resembling speech. A device which will mechanically compose artificial words from word fragments was designed and partially constructed. Studies are described which propose solutions to scanning problems.

Mellon Inst. [of Industrial Research, U. of Pittsburgh, Pa.]
HIGH TEMPERATURE PRINTED CIRCUITRY, by G. H. Young, C. H. T. Wilkins and others. Quarterly rept. no. 10, third series, 1 Jan-31 Mar 59, on Computer Components Fellowship no. 347, Contract AF 19(604)1959. 1959, 55p. 11 refs. AFCRC-TN-59-777.
Order from LC mi$3.60, ph$9.30 PB 144 545

Continued investigations regarding the development of high temperature, passive, two-dimensional, printed circuitry have included: surface resistivity studies; further development of film capacitors; metal film resistor studies; and development of non-glaze-containing, screen-painted enamel circuits. (See also PB 138 813)

Michigan U. Research Inst., Ann Arbor.
INVESTIGATION OF MICROWAVE PROPERTIES OF FERROELECTRIC MATERIALS, by C. B. Sharpe. Quarterly progress rept. no. 2, 1 May-1 Aug 58 on Contract DA 36-039-sc-75003. Aug 58, 15p. 3 refs. 2732-2-P.
Order from LC mi$2.40, ph$3.30 PB 138 790

A theory based on the scattering matrix approach is presented for high dielectric constant materials. Correction formulas for the non-uniform field effect in disc and rectangular shaped samples at high frequencies have been verified.

Michigan U. [Research Inst.] Ann Arbor.
PRODUCTION OF LARGE TRANSIENT CURRENTS BY INDUCTIVE ENERGY STORAGE, by R. C. Walker and H. C. Early. Rept. on Contract AF 40(600)720. Dec 57, 21p. 2 refs. 2665-2-T.
Order from LC mi$2.70, ph$4.80 PB 144 549

Research involving transient currents of the order of 10^6 to 10^7 amperes involves peak power levels which are larger than can ordinarily be obtained from a utility power line. Some form of intermediate energy storage is usually desirable which will permit taking energy from the power line over a period of seconds or minutes and then discharging the energy over a

much shorter interval. The relative merits of several methods of energy storage were discussed in an AIEE paper. In this paper it is shown that storage of electrical energy in a magnetic field is often economically advantageous in situations where the energy is in the megajoule range and the discharge current pulse has a duration of several milliseconds.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
DISCONTINUITIES IN THE CENTER CONDUCTOR OF SYMMETRIC STRIP TRANSMISSION LINE, by H. M. Atschuler and A. A. Oliner. Rept. on Contract AF 19(604)2031. 13 July 59, 38p. 11 refs. Research rept. R-749-59; PIB-677; AFCRC-TN-59-599.
Order from LC mi$3.00, ph$6.30 PB 144 437

A systematic measurements program has been carried out to check the validity of theoretical formulas for the equivalent circuit parameters of a variety of discontinuities in the center conductor of symmetric strip transmission line. These theoretical formulas have been in part previously available and are in part new or modified. Results indicate that, in general, these formulas are adequate for most engineering purposes and that certain of the network parameters can be neglected.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
OPTIMUM VOLTAGE TRANSFER EQUALIZATION FOR A REACTIVE LOAD AND A FINITE GENERATOR, by Walter H. Ku. Rept. on Contract Nonr-839(05). 13 Feb 59, 17p. 5 refs. Research rept. R-678-58; PIB-606; AD-218 471.
Order from LC mi$2.40, ph$3.30 PB 144 822

The problem of designing the optimum coupling networks is considered. A definitive result was obtained for the ratio of voltage gain of a dissipative matched equalizer to that of a reactive equalizer for a given lossless load when a generator with a finite internal resistance is used. If the voltage ratio is prescribed with a normalized shape f(w), and the maximum possible scale factor consistent with physical realizability is K_M for a matched equalizer and K_X for a lossless equalizer, then in general for any realizable f(w), $K_X/K_M = \sqrt{2}$. Examples comparing the performance of optimum matched and optimum lossless equalizers are presented. (Author)

Motorola, Inc., Chicago, Ill.
RESEARCH AND DEVELOPMENT OF CATHODE RAY TUBES, by Kurt Schlesinger. Final rept. on Contract DA 36-039-sc-64614. [1958] 281p. 26 refs. AD-157 744.
Order from LC mi$11.10, ph$44.10 PB 144 914

Electrostatic wide angle deflection (65 degrees) from a common center has been accomplished with "soft" beams (2 to 4 KV), using specially developed electrostatic yokes, or "Deflectrons". The new wide angle Deflectrons consist of a glass cone, 1-1/2" long, whose inside surface carries a plated metal pattern with 4 terminals. Pincushion distortion and noncircularity has been corrected by special geometry of the printed pattern, notably the "sine^2 graded pitch" type. Post acceleration from 2.5 KV to 25 KV has been accomplished, without any loss of deflection, by a new "barrier mask" intensifier using a high-transmission (50%), etched, metallic, dome of high resolution (3.10^5 holes at 18" diameter). Secondary emission from the first surface has been cancelled by a coat of magnesium oxide on a base of enamel, using a barrier bias of 100 volt relative to an adjacent wire collector. Three types of displays have been built using this combination: (1) A single gun, 19" - 65° electrostatic radar indicator. (2) A dual deflection tube, using a single gun but two aligned Deflectrons in sequence. (3) An all electrostatic character writing tube, called "Printoscope". This latter tube uses a total of five Deflectrons; four are grouped in two Tandem units for character selection; one is used for address. Performance records and special circuit information are included in the report. (Author)

Naval Ordnance Test Station, China Lake, Calif.
AN ALL TRANSISTOR PDM TELEMETRY CODER, by James S. Sherwin. 1 June 57, 12p. NOTS-1807; NAVORD rept. 5600; AD-146 367.
Order from LC mi$2.70, ph$4.80 PB 144 721

This report describes an all transistor PDM telemetry coder that is very linear, is unaffected by variations in signal voltage during the information pulse, and is free from the microphonic effects encountered in vacuum tube circuits. The complete circuit includes an astable blocking oscillator pulse-rate generator, a voltage-controlled delay multivibrator (DMV) encoder, and a gated memory circuit which prevents variations in signal voltage from appearing at the input to the DMV during the information pulse. The coder operates at a pulse rate of 900 ± 5 pps, exhibits a transfer function linear to within $\pm 0.5\%$, and can be calibrated to 0.1%. Seven silicon transistors are utilized. (Author)

Naval Research Lab., Washington, D. C.
CALCULATION OF TRANSIENT DISCHARGES BETWEEN SEPARATING CONTACTS, by H. E. Strauss and C. W. Klee. Interim rept. 13 Jan 60, 16p. 9 refs. NRL Rept. 5416.
Order from OTS $0.50 PB 161 024

A criterion has been formulated for the prediction of the type of transient–repetitive short arcs or glow–to be expected between separating contacts interrupting a current too small to cause drawing-out of an arc. In simple form, the criterion is that when the current calculated for an assumed glow transient, using a formula based on an idealized relationship of voltage and current involving constant parameters, is less than a critical current, a glow discharge forms, and when the calculated current is greater, an arc discharge forms. If a glow discharge occurs, the energy in the circuit is sufficiently dissipated at the end of this discharge that only circuit oscillations follow. If an arc occurs, generally energy conditions in the circuit will be such that the gap voltage rebuilds to the breakdown potential; and usually this occurs a number of times resulting in a series of arcs. In order to evaluate the merit of the criterion and the assumed parameters, transients were observed experimentally in the simple circuit on which the

analysis was based and compared with the calculated transients. The agreement found between the two encourages confidence in the basic assumptions that permitted selections of a criterion and of discharge parameters. (Author)

Naval Research Lab., Washington, D. C.
INVERSE NETWORKS, by Charles F. White. Final rept. 23 Nov 59, 11p. 2 refs. NRL rept. 5420.
Order from LC mi$2.40, ph$3.30 PB 143 407

"Inverse networks" are introduced as a class of two terminal-pair, linear, passive, structurally dual networks. From a given network composed of combinations of lumped resistance, inductance, and capacitance another "inverse" network with an identical voltage transfer function may be formed by use of the concept of inverse impedances together with a topological transformation procedure that is presented.

Naval Research Lab., Washington, D. C.
SUBMERGED VLF RECEPTION; A STUDY OF VARIOUS LOOP COUPLING METHODS, by S. V. Fratianni. 31 Dec 46, declassified 15 Dec 53. 19p. 6 refs. Rept. R-2872.
Order from LC mi$2.40, ph$3.30 PB 144 601

This problem provides for research to yield more effective submerged reception, the present phase relating to the attainment of the best energy transfer from the collecting loop to the receiver. Various coupling units available to the service have been studied. While the study of couplings is the prime consideration, it was found desirable to include the limitations of the various couplers and their usefulness to the Navy.

Naval Research Lab., Washington, D. C.
TWO-DIMENSIONAL TRACKING WITH IDENTICAL AND DIFFERENT CONTROL DYNAMICS IN EACH COORDINATE, by R. Chernikoff, J. W. Duey, and F. V. Taylor. Interim rept. 27 Nov 59. 7p. 2 refs. NRL rept. 5424.
Order from LC mi$1.80, ph$1.80 PB 143 803

In many complex tracking devices, the control dynamics may differ in the various coordinates. This requires the operator to supply a different transfer function in each tracking dimension. The purpose of this investigation was to determine the effect upon tracking produced by using various pairings of position, rate, and acceleration control dynamics in the X and Y coordinates of a two-dimensional tracking system. The results indicate that in all cases, minimum error occurred when the dynamics in the two coordinates were the same and that error increased as the dissimilarity between the dynamics became greater. These findings are interpreted as suggesting that a human has a limited information-handling capacity, that some of this capacity is used to change from one task to another, and that the greater the difference between control tasks the less the capacity which remains for the performance of either. (Author)

Naval Research Lab., Washington, D. C.
THE USE OF QUICKENING IN ONE COORDINATE OF A TWO-DIMENSIONAL TRACKING SYSTEM, by J. W. Duey and R. Chernikoff. Interim rept. 30 Nov 59, 6p. 3 refs. NRL rept. 5428.
Order from LC mi$1.80, ph$1.80 PB 143 801

In a previous study, it was found that tracking error in one coordinate of a two-dimensional tracking system was affected by the dynamics used in the other coordinate. In particular, tracking performance progressively deteriorated as the dynamics in the two coordinates became more dissimilar. The present study sought to extend these findings by determining how the introduction of quickening into one coordinate of a second-order, two-coordinate tracking system would affect performance in the unquickened coordinate. In the light of the previous study, it might be expected that quickening one coordinate would degrade the performance of the other. On the other hand, the simplification of the tracker's task induced by quickening might effect an improvement in performance. The findings suggest that a counterbalance of the above factors was achieved, since quickening one coordinate did not affect performance in the other. (Abstract)

Navy Electronics Lab., San Diego, Calif.
HUMAN FACTORS IN THE DESIGN AND UTILIZATION OF ELECTRONICS MAINTENANCE INFORMATION, by J. H. Stroessler, J. M. Clarke and others. 31 May 57, 36p. 11 refs. Research rept. 782; AD-149 158.
Order from LC mi$3.00, ph$6.30 PB 144 662

The results of the survey are summarized in the report proper and are given in full in Appendix C.

Navy Electronics Lab., San Diego, Calif.
A SIMPLIFIED DISTORTION ANALYZER, by H. E. Chubb and S. H. Sessions. 13 July 57, 17p. 8 refs. Research and Development rept. 789; AD-205 995.
Order from LC mi$2.40, ph$3.30 PB 144 661

The problem was to develop a simple technique and equipment for measuring audio distortion in sonar trainers, particularly those using phonographic or magnetic-tape input, as an aid to maintenance technicians in making rapid checks on and locating malfunctions in trainers and similar equipments.

Navy Electronics Lab., San Diego, Calif.
STUDIES IN HUMAN CONTROL DYNAMICS, by M. Lichtenstein. Rept. for Sep 54-May 56. 7 Oct 57, 37p. Research and Development rept. 805; AD-206 439.
Order from LC mi$3.00, ph$6.30 PB 144 724

The continuous control performances of operators were studied in relation to system input characteristics, control system transfer functions, tracking mode, and display factors. Analyses of results were made in terms of integrated track errors, input and

output auto- and cross-correlation functions, spectrum analyses, and phase-plane diagrams. Some hypotheses about control action were developed. Some applications of test results to engineering design of man-operated control systems are suggested.(Author)

Navy Experimental Diving Unit, Naval [Weapons Plant] Washington, D. C.
THE PERFORMANCE OF UNDERWATER TELEVISION USING BOTH NATURAL AND ARTIFICIAL ILLUMINATION, by J. R. R.Hartner, G. M. Janney, and T. L. Rakoskie. Interim rept. 2 June 59, 41p. Research rept. 2-59; AD-226 794.
Order from LC mi$3. 30, ph$7. 80 PB 144 673

A study of the performance of underwater television using natural and artificial illumination was started. The hydrological range capabilities of various television systems were measured. Various combinations of commercial sources of illumination were tested both in the day-time and at night. The initial results show that, in relatively turbid water, the night-time performance is somewhat superior to the performance possible in the day-time. (Author)

New York U. Coll. of Engineering, N. Y.
ON THE WIENER PREDICTION PROBLEM AND THE PROBLEM OF THE OPTIMIZED, NOISEFREE AUTOMATIC CONTROLLER, by Nils Ashlund. Rept. on Contract AF 49(638)586. Oct 59, 19p. 6 refs. Technical note 400-2; AFOSR-TN-59-1100.
Order from LC mi$2. 40, ph$3. 30 PB 144 783

A solution of the Wiener prediction problem in the sampled, non-stationary case has been presented by Kalman. The method used is founded on statistical orthogonal projections. Kalman and Koepcke have also presented a solution of the problem of minimizing a generalized loss-function defined for a sampled, noisefree automatic controller. Here dynamic programming is used. The solutions of the two problems have structural resemblances and the problems are called the duals of each other by Kalman, who finds the close resemblance very surprising.

Office of Scientific Research and Development. Div. 14.
X-BAND VIDEO CRYSTALS, by W. E. Meyerhoff and W. E. Stephane (Pennsylvania U.). Rept. on Contract OEMsr-[383] 20 May 44, declassified, 11p. 4 refs. Rept. no. 274; ATI-21 017.
Order from LC mi$2. 40, ph$3. 30 PB 144 648

Procedures are described for the manufacture of X-band video crystals with an average figure of merit of over 100. Their resistance averages 20,000 ohms. Pulses of about 0. 6 erg cause the figure of merit to decrease by 20%. These crystals are fairly stable, the figure of merit changing ±10% on the average over a week's time. (Author)

Office of Scientific Research and Development. Div. 17.
RESPONSE CHARACTERISTICS OF INTERPHONE EQUIPMENT NUMBER 3 INCLUDING INFORMATION ON PROPOSED STANDARD TEST METHODS FOR HEADSET RECEIVERS AND MICROPHONES, by H. W. Rudmose, F. M. Wiener and others (Cruft Lab.) Rept. on Contract OEMsr-658. 1 Mar 43. declassified 10 May 46. 132p. OSRD rept. no. 1095; ATI-158 961.
Order from LC mi$6. 90, ph$21. 30 PB 144 518

This report records the results of an experimental program planned to investigate and to develop where necessary suitable methods for testing the physical properties of military interphone equipment. The research reported here was started at the request of the late Commander Malcolm P. Hanson of the Navy Department Bureau of Aeronautics. Part of this program has been covered in two previous transmittals of the same title, dated January 30 and June 23, 1942. Information is now being obtained on the effects of reduced pressure and low temperature on the behavior of the human voice, and will be presented at a later date. The earlier reports contain tentative methods of testing microphones and headphones, but following further experience, certain revisions have seemed necessary. It is believed that those test methods advocated at this writing are suitable for use in preparing specifications. Part of the procedures have already been adopted by the United States Army and Navy.

Radio Condenser Co., Camden, N. J.
VARIABLE CAPACITOR DEVELOPMENT, by E. J. Caron. Quarterly rept. no. 1, 1 Feb-1 May 58, on Contract NObsr-72751. 12 May 58, 13p.
Order from LC mi$2. 40, ph$3. 30 PB 144 954

Radio Condenser Co., Camden, N. J.
VARIABLE CAPACITOR DEVELOPMENT, by E. J. Caron. Quarterly rept. no. 2, 1 May-1 Aug 58, on Contract NObsr-72751. 15 Aug 58, 20p. AD-219 009.
Order from LC mi$2. 40, ph$3. 30 PB 144 872

A method of evaluating variable capacitors for small variations of capacity when under vibration was satisfactorily achieved. These variations can be measured in terms of frequency where the capacitor is the tuning element of a 16 - 32 mc oscillator. (Author) (See also PB 144 954)

Radio Condenser Co., Camden, N. J.
VARIABLE CAPACITOR DEVELOPMENT, by E. J. Caron. Quarterly rept. no. 3, 1 Aug-1 Nov 58, on Contract NObsr-72751. 17 Nov 58, 30p.
Order from LC mi$2. 70, ph$4. 80 PB 144 873

The variable capacitor to be built under this contract has a specification of frequency deviation when subjected to vibration and used to tune an oscillator over the 16 - 32 Mc. range. The specification calls for a maximum deviation of 100 cycles. A number of variable capacitors were evaluated for frequency deviation when subjected to vibration and used as the tuning element of a 16 Mc. oscillator. These capacitors were selected to cover a reasonable range of construction variables such as air gap, plate size, frame, etc. In addition, modifications were made and evaluated. The lowest deviations on standard capacitors exceeded

1200 cycles. The data taken in this report period will be valuable in determining the structure of a special capacitor unit which will be built to permit the various capacitor parameters to be evaluated independently. (Author) (See also PB 144 872)

Radio Condenser Co., Camden, N. J.
VARIABLE CAPACITOR DEVELOPMENT, by E. J. Caron. Quarterly rept. no. 4, 1 Nov 58-1 Feb 59, on Contract NObsr-72751. 13 Feb 59, 26p.
Order from LC mi$2.70, ph$4.80 PB 144 874

A rugged capacitor frame structure was built to permit evaluation of various parameters independently. The first group of findings (evaluation of deviation in terms of plate hardness) is nearly complete. Under vibration at 55 cycles per second, the average high quality stable capacitor has a frequency deviation of 4,000 cycles. Some structures show deviations as low as 1,200 cycles. Modifications can be made to obtain reductions in the order of 50 percent. Effects of variations of each parameter involved are being analyzed to obtain information which will permit making a design incorporating the optimum value in each case. Thus a design of very low frequency deviation will be achieved. (Author) (See also PB 144 873)

Radio Condenser Co., Camden, N. J.
VARIABLE CAPACITOR DEVELOPMENT, by E. J. Caron. Quarterly rept. no. 5, 1 Feb-1 May 59, on Contract NObsr-72751. 15 May 59, 18p.
Order from LC mi$2.40, ph$3.30 PB 144 875

This report covers a series of experiments to determine the manner in which the design parameters of a variable air capacitor affect the frequency stability of an oscillator using this capacitor as the main frequency determining element. The parameters investigated include air gap, rotor and stator plate thickness, rotor plate radius, and rotor and stator plate hardness. A rugged frame structure was built in such a manner that these parameters could be investigated independently of other factors. The data obtained has been used to design a capacitor with high stability against vibration and of a size which is reasonable and practical. (Author) (See also PB 144 874)

Radio Corp. of America, Princeton, N. J.
DEVELOPMENT OF AN ELECTROSTATICALLY FOCUSED MEDIUM-POWER TRAVELING-WAVE AMPLIFIER FOR S-BAND, by D. J. Blattner and F. E. Vaccaro. Final rept. for 1 Dec 56-31 Mar 58 on Contract AF 19(604)1947. [1958] 43p. 3 refs. AFCRC-TR-58-127; AD-152 363.
Order from LC mi$3.30, ph$7.80 PB 137 828

Work performed has demonstrated the feasibility of operating traveling wave tubes with electrostatic focusing over a wide range of power levels. With no compromise of the advantageous features of traveling wave amplifiers - wide bandwidth, high gain, linear small-signal amplification - many of their disadvantages have been removed. Thus the electrostatically focused traveling wave amplifier requires no magnetic focusing field, (hence no alignment), is light in weight, and can be made as independent of environmental conditions as any thermionic tube vacuum tube.

Raytheon Mfg. Co. Newton, Mass.
INDUSTRIAL PREPAREDNESS STUDY ON TRANSISTORS AND AUTOMATIC MACHINERY FOR THEIR MANUFACTURE, by Frank M. Dukat and G. Freedman. Quarterly rept. no. 8, 28 Dec 56-28 Mar 57, on Contract DA 36-039-sc-66038. [1957] 28p. AD-159 992.
Order from LC mi$2.70, ph$4.80 PB 138 094

Tentative specifications for the QC-117 transistor, based on the Type 30 welded package, are being discussed. The introduction of small quantities of boron in the emitter results in considerable beta improvement and also in improved voltage saturation. (See also PB 129 406)

Raytheon Mfg. Co., Newton, Mass.
INDUSTRIAL PREPAREDNESS STUDY ON TRANSISTORS AND AUTOMATIC MACHINERY FOR THEIR MANUFACTURE, by Frank M. Dukat and George Freedman. Quarterly rept. no. 10, 28 June-28 Sep 57, on Contract DA 36-039-sc-66038. [1957] 21p. AD-159 994.
Order from LC mi$2.70, ph$4.80 PB 138 054

Results of QC-131 lifetime tests to 2000 hours indicate good shelf life characteristics, relatively stable beta and acceptable Ico performance for room temperature and high temperature and operating storage conditions. (See also PB 138 050)

Raytheon Mfg. Co., Newton, Mass.
INDUSTRIAL PREPAREDNESS STUDY ON TRANSISTORS AND AUTOMATIC MACHINERY FOR THEIR MANUFACTURE, by Frank M. Dukat and George Freedman. Quarterly rept. no. 11, 28 Sep-28 Dec 57, on Contract DA 36-039-sc-66038. [1957] 14p. AD-159 995.
Order from LC mi$2.40, ph$3.30 PB 138 055

The reproducibility of boron-aluminum alloys for fused-junction LF silicon transistor (type QC-131) emitters was studied. The use of boron-aluminum and tin instead of boron-tin and aluminum emitter alloys improved the falloff of hfe (small-signal short-circuit forward-transfer current ratio) vs I_e (emitter current), and the saturation resistance. The boron-aluminum ribbon alloys, which were successfully used on experimental units, were tried on pilot production of the QC-131. Results were satisfactory. A diluted etching solution improved pilotline yields at the in-line test stage and lowered the base resistance. (See also PB 138 054)

Raytheon Mfg. Co., Newton, Mass.
SILICON POWER TRANSISTORS (DEVICES 15 AND 16), by Frank M. Dukat and George Freedman. Final rept. for 1 Jan-30 Oct 57 on Feasibility Study of Diffused Semiconductor Devices, Contract DA 36-039-sc-72710. [1957] 105p. AD-207 652.
Order from LC mi$5.70, ph$16.80 PB 138 052

Feasibility, both mechanical and electrical, has been demonstrated for Device 15 and for Device 16 to a modified specification. This has been done by the approach of double diffusion for which two feasible variations are described.

Raytheon Mfg. Co., Newton, Mass.
SILICON VIDEO AMPLIFIER (DEVICE 25), by John Sardella, Anthony Caggiano and others. Quarterly rept. no. 1, 12 Sep-12 Dec 57, on Industrial Preparedness Study on Transistors, Contract DA 36-039-sc-72710. [1957] 38p. AD-207 653.
Order from LC mi$3.00, ph$6.30 PB 138 051

Rome Air Development Center, Griffiss AFB, N. Y.
PHASED ARRAYS, by George J. Vogel. Nov 59, 63p. 7 refs. RADC-TR-59-135.
Order from LC mi$3.90, ph$10.80 PB 144 775

In conventional radars, the antenna physically moves to cause the radar beam angle to change. The physical limitations of this antenna movement impose serious restrictions on the uses to which this radar can be put. In Phased Arrays, the antenna does not move. The beam angle is changed by electronic means. This report presents the author's effort on phased arrays over the past year (1958). The author describes how the beam position is determined, some limitations peculiar to phased arrays and an improvement. A number of techniques using the advantages of phased arrays (that normal radars do not have) are also presented. To make the most of the proposed radars, considerable computer and hardware design must be accomplished. (Author)

Seattle U., Wash.
RESEARCH ON TRAVELING WAVE ANTENNAS, by Donald K. Reynolds and Rubens A. Sigelmann. Final rept. on Contract AF 19(604)4052. June 59, 37p. 2 refs. AFCRC-TR-59-160; AD-217 821.
Order from LC mi$3.00, ph$6.30 PB 144 657

Continuously excited traveling wave antennas: By means of the continuous excitation of a long (40λ) Yagi antenna by a two wire transmission line, periodic interchanges of energy between the line and the antenna can be obtained. The amplitude modulation of the surface wave on the antenna produced in this matter gives rise to useful end-fire radiation characteristics over a wide frequency band. Twisted Yagi antennas: Results are presented on a 40 λ twisted Yagi, with 4 identical twist sections. This antenna is shown to have useful end-fire characteristics and high directivity, although with very high side lobe levels. Distributed excitation of uniform traveling wave antennas: By means of a distributed exciter, which spreads the excitation of a 10 λ uniform Yagi antenna over the first quarter of the length of the antenna, a radiation pattern is obtained which is very nearly that of an ideal uniformly excited end-fire line source operating such as to produce maximum forward gain. Traveling wave antennas with broad pattern bandwidth: This investigation attacks the problem of non-uniform linear arrays, operated such that at a given frequency only a portion of the array can support a surface wave. By this means it is hoped to provide a substantially constant radiation pattern over a large frequency band. Preliminary results are presented. (Author)

Semiconductor Lab., Hughes Products, Los Angeles, Calif.
HIGH-FREQUENCY SILICON TRANSISTOR, by T. W. Griswold. Supplementary Feasibility rept. for 1 Sep-31 Oct 57 on Contract DA 36-039-sc-72702. [1957] 16p.
Order from LC mi$2.40, ph$3.30 PB 138 484

The techniques used to make Device 21 have been refined to the practical limit in an effort to meet the requirements of Device 22. Process changes to vary the depth of penetration, base width, base and emitter doping have been made. (See also PB 133 238)

Stanford Electronic Labs., Stanford U., Calif.
AN APPLICATION OF THE THEORY OF GAMES TO RADAR RECEPTION PROBLEMS, by N. J. Nilsson. Rept. on Contracts AF 19(604)1847 and Nonr-225(24). 21 Apr 58, 114p. 16 refs. Technical rept. no. 704-1.
Order from LC mi$6.00, ph$18.30 PB 138 585

Stanford Electronic Labs., Stanford U., Calif.
A 2-8 kMc BIFILAR HELIX BACKWARD-WAVE OSCILLATOR, by R. W. Grow and D. A. Dunn. Rept. on Contract DA 36-039-sc-73178. 29 Sep 58, 16p. 6 refs. Technical rept. no. 382-1; AD-207 852.
Order from LC mi$2.40, ph$3.30 PB 137 914

This paper describes a very wide band voltage tunable bifilar helix backward-wave oscillator for use in a signal generator or for other low power applications. The oscillator tuned continuously from 2 to 8 kmc with a voltage variation of 76 to 2140 volts. With 5 ma of beam current it produced between 6 and 240 mw of RF power over this frequency range. The operating curves were reasonably smooth throughout the tuning band, making it both practical and useful as an electronically tunable oscillator. (Author)

Stanford Electronics Labs., Stanford U., Calif.
THE USE OF DOPPLER SHIFT FOR THE DIRECTIONAL RESOLUTION OF RECEIVED SIGNALS, by E. Gehrels. Technical rept. no. 32 on Contract Nonr-225(24). 21 Apr 58, 130p. 15 refs.
Order from LC mi$6.30, ph$19.80 PB 138 549

This dissertation describes a way in which two or more signals of the same radio frequency, but of a different direction of arrival, may be resolved by taking advantage of the above Doppler shift. In this case the received signal consists of the sum of the various individual signals, each having a superimposed frequency modulation whose characteristics depend on the direction of arrival of that particular signal component. By properly processing the composite signal the individual components can be separated, thus achieving directional discrimination analogous to that of a directional antenna. Because of this analogy, the rotating antenna system is called a "Doppler array."

Stanford Research Inst. [Menlo Park] Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 1, 1 July-30 Sep 54, on Contract DA 36-039-sc-64454. 13 Oct 54, 30p. 21 refs.
Order from LC mi$2.70, ph$4.80 PB 145 045

This report presents the results of a literature survey dealing with various aspects of insulator contamination. On the basis of this survey and of discussions with members of this and other laboratories, certain recommendations for the conduct of the research program have been made. (Author)

Stanford Research Inst [Menlo Park] Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 2 1 Oct-31 Dec 54, on Contract DA 36-039-sc-64454. 25 Jan 55, 57p. 7 refs.
Order from LC mi$3.60, ph$9.30 PB 145 046

Accelerated conditions for contamination of samples by migration of silver from electrodes were developed, and studies of the effect of relative humidity, voltage, certain cleaning procedures, and other treatments were made on the paper-base phenolic laminate, Grade XXXP. Silver migration was promoted by high humidities and voltages, and by certain cleaning methods. Using about ten different samples of plastics, filled and unfilled, the effect of fingerprints on the d-c surface resistance was studied. The presence of iron was demonstrated in an etched sample of copper-clad XXXP by using sensitized filter paper. A sensitive filter paper test for the presence of rosin, a universal ingredient of fluxes for electronic use, was developed. To become familiar with the operation of the contamination chamber, aerosols of sodium chloride were generated in the presence of XXXP samples. (See also PB 145 045)

Stanford Research Inst. [Menlo Park] Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 3, 1 Jan-31 Mar 55, on Contract DA 36-039-sc-64454. 4 May 55, 66p.
Order from LC mi$3.90, ph$10.80 PB 145 047

The susceptibility of various materials to migration of silver from electrodes was investigated. Solder coating of silver, as a preventive measure, was also studied; it was found that the net volume of silver migration, on XXXP, was greatly reduced but that its damaging effects were only somewhat lessened. The relative behavior of a number of new materials in a standard humidity cycle was ascertained before and after contamination with fingerprints. The materials included Telfon-glass, epoxy-glass, diallyl phthalate-glass, Kel-F, neoprene, polyvinylchloride, cellulose acetate butyrate, steatite, and pyrex glass. A study of etching time (with ferric chloride) vs resistivity showed that exposure of XXXP panel in the etching solution for about five times as long as was necessary to remove copper from it had no serious degrading influence on its surface resistivity. Three rosin-alcohol fluxes of various degrees of activation were studied in regard to their effect on surface resistance of XXXP. The effect of contamination of XXXP, N-1, G-6, G-5, Teflon-glass, and epoxy-glass with sodium chloride and sulfuric acid aerosols was studied. Occurrences of insulation failure in a commercial printed circuit panel are being investigated. (See also PB 145 046)

Stanford Research Inst. [Menlo Park] Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 4, 1 Apr-30 June 55, on Contract DA 36-039-sc-64454. 25 July 55, 38p. 1 ref.
Order from LC mi$3.00, ph$6.30 PB 145 048

The susceptibility to silver migration of diallyl-phthalate-glass, Kel-F, Mycalex 400, and a new sample of N-1 was studied. Gold flash was tested as a silver migration preventive and found to be almost completely successful. An improvement in the method of detection of surface iron and copper was made by sensitizing the test paper with o-phenanthroline. Using this improved paper, the effect of etching time and washing time on the retention of iron by XXXP was determined and, where possible, was correlated with changes in surface resistivity. Fingerprints on Mycalex 400 were found not to lower the high humidity resistance below that to which a clean sample is reduced in that environment. Tests of unfluxed XXXP samples and fluxed and dip-soldered XXXP samples that had been exposed to airborne dust for a month showed that the high humidity surface resistance of the former was much more seriously lowered than that of the latter. A standing potential of 480 v dc on a fingerprint-contaminated XXXP sample at high humidity improved the surface resistance by a factor of 17 in 20 hours. Printed circuit processes used by a number of West Coast companies were studied in relation to the contaminants problem. (See also PB 145 047)

Stanford Research Inst. Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 5, 1 July-30 Sep 55, on Contract DA 36-039-sc-64454. 11 Nov 55, 38p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 145 049

It was found that silver will not undergo migration when it is present in chemical combination with another metal. For the occurrence of silver migration, silver must touch the base material. However, it was found that a link between the silver and the base material could be formed by a fiber or a dust particle, permitting silver migration to occur. Cadmium plating was also shown to prevent migration. In the first of a series of experiments dealing with the prevention of silver migration by surface treatment, migration on XXXP and melamine-glass laminates was reduced about 75% by pre-treatment of the laminates with a silicone emulsion. The nature of contamination of glass-fiber-filled melamine and Teflon laminates by silver migration was shown with photomicrographs of silver migrated samples of these materials. In comprehensive experiments using XXXP base material the effect of etching time and washing time on surface resistance was studied, as was also surface retention of iron and copper. An improved test for surface iron and copper based on zinc ferrocyanide was developed. Abrasion of etched XXXP panels, an operation normally employed to remove the photoresist which protects copper during etching, was shown to improve surface resistance and to reduce greatly the quantity of surface iron and copper. No serious surface leakage was found from

several commercial activated rosin-base solder fluxes when tested either before or after dip-soldering, even after one week of storage at 97% relative humidity. Ferric oxide, and only ferric oxide, was identified as the precipitate which formed in a used ferric chloride etching solution. (See also PB 145 048)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 6, 1 Oct-31 Dec 55, on Contract DA 36-039-sc-64454.
31 Jan 56, 48p.
Order from LC mi$3.30, ph$7.80 PB 145 050

A commercial silver conducting ink, designed for the fabrication of printed circuits by direct screening on an insulating base material, was tested for silver migration. The silver underwent very extensive migration on Mycalex, slight migration of XXXP, and no migration on epoxy-glass. Fourteen electronic components containing silver-plated or silver alloy parts were tested for silver migration. Migration occurred on dielectrics of seven of the components, four extensively enough so that ultimate failure of the component was indicated. The susceptible dielectrics were steatite, nylon, and the paper-base phenolic laminate, XXXP. A practical, general test for contamination is suggested, based on leakage resistance measurements at low and high humidity. A study of the effect of the degree of exhaustion of the etching bath on the surface resistance of etched circuits showed no correlation. Continued study was given to a comparison of activated rosin-base solder fluxes in their effect on the surface resistance of XXXP. None of the activated fluxes tested introduced leakage caused by the activator, even through a strenuous and degrading temperature-humidity cycling procedure lasting one month. The effect of MFP (Moisture and Fungus Proof) varnish on the surface resistance of contaminated and uncontaminated printed circuits was studied using XXXP. The effect of surface contamination on the a-c property, Q, at 50 megacycles, was studied in preliminary experiments. Q is a measure of the quality of a dielectric with respect to energy losses. These experiments showed that, with fingerprint contamination, a 30% drop in Q occurred in measurements at 97% relative humidity. (See also PB 145 049)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 7, 1 Jan-31 Mar 56, on Contract DA 36-039-sc-64454.
30 Apr 56, 42p.
Order from LC mi$3.30, ph$7.80 PB 145 051

Three types of silver-containing printed circuits were studied with respect to silver migration. A commercial sample of the type made from pressed silver powder underwent extensive migration. Commercial samples of circuits made by chemical deposition of silver followed by plating of copper were tested, and a slight to moderate amount of migration was found to occur, although the layer of silver present was extremely thin. Silver-plated etched copper circuits supported migration on both XXXP and on epoxy-glass laminates. Various printed circuit washing solutions in commercial use were evaluated with respect to their contaminating etched boards (not with respect to thoroughness of etchant removal) and none of those tested was found to degrade circuits seriously, if the circuits were made from XXXP or epoxy-glass laminates. The solvents acetone, toluene, and trichloroethylene were found not to degrade the surface resistance of the XXXP and epoxy-glass samples upon which they were tested; in fact, with some samples (particularly epoxy-glass) the effect on the resistance was a beneficial one. Baths for electroplating solder, silver, nickel, and rhodium were studied. It was found that solder-plating, using a fluoborate bath, did not affect the insulation resistance of the XXXP or epoxy-glass samples. Silver plating, however, caused an appreciable drop in resistance of both the XXXP and epoxy-glass samples. The nickel-and rhodium-plating treatments resulted in slight to moderate lowering in the surface resistance of some samples of both types of laminates. Fingerprint and ferric chloride contamination reduced Q about 30-50% with XXXP and epoxy-glass laminates. The behavior of uncontaminated samples upon introduction into high humidity was quite variable. Printed circuits having samples of three types of protective coatings specially developed for the Signal Corps were submitted by them for testing. Two of the three were much superior to the other in insulation resistance tests at high humidity. (See also PB 145 050)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 8, 1 Apr-30 June 56, on Contract DA 36-039-sc-64454.
20 Aug 56, 52p. 5 refs.
Order from LC mi$3.60, ph$9.30 PB 145 052

Because the end result of silver migration in electronic equipment can be dielectric failure, the use of silver is commonly avoided. Although data from this and other research efforts have outlined the parameters affecting silver migration, these data cannot always be used as a guide to predicting the occurrence of silver migration in real situations. A scheme has been developed which would relate the various parameters by means of a nomograph. Exploratory experiments were made in which the effect of temperature, at 95-100% relative humidity, on silver migration was investigated. In an additional experiment pertaining to the temperature-humidity relationship, the danger of silver migration in a piece of equipment at high humidity before and after warm-up was evaluated. Silver migration from coin silver, an alloy containing 10% copper, was found to be enormously less than that from pure silver. Various printed circuit washing solutions in commercial use were evaluated with respect to thoroughness of etchant removal. The most effective washing solutions on both XXXP (a paper-base phenolic laminate) and epoxy-glass were hydrochloric acid, Pluronic L-62 (a non-ionic detergent), and, possibly, Versene. Activated-rosin soldering fluxes were studied further by means of a new test which was developed to explore contamination by solder flux decomposition products. Significant differences among activated fluxes were demonstrated in preliminary experiments. The resistance of se-

lected samples as a function of relative humidity, continuously changed at a uniform rate, was measured, and the results interpreted in terms of conductivity in a surface film of water and, to some extent, in the volume of the material. A circuit was developed for studying the change in resistance of a dielectric at high humidity as a function of applied voltage and of time. The results of experiments with XXXP show that increased voltage and a standing potential improve resistance. (See also PB 145 051)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 9, 1 July-30 Sep 56, on Contract DA 36-039-sc-64454. 1 Nov 56, 24p.
Order from LC mi$2.70, ph$4.80 PB 145 053

Progress is reported for work accomplished on the following phases: (1) the problem of relay contact contamination, for which a background was acquired for use in setting up for a laboratory study; (2) surface contamination of glass hermetic seals in capacitors; (3) development of a method for predicting the occurrence of silver migration; (4) inhibition of silver migration by alloying the silver; and (5) contamination of etched circuits by solder fluxes. (Author) (See also PB 145 052)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON ELECTRICAL MATERIALS, by S. Chaikin. Quarterly progress rept. no. 10, 1 Oct-31 Dec 56, on Contract DA 36-039-sc-64454. 31 Jan 57, 39p.
Order from LC mi$3.00, ph$6.30 PB 145 054

Progress is reported for work accomplished on the following phases: (1) the problem of relay contact contamination, for which an analytical procedure was developed and the thermal stability of insulating materials studied; (2) surface contamination of glass hermetic seals in capacitors; and (3) a method for predicting the occurrence of silver migration on phenolic-paper laminate. (Author) (See also PB 145 053)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON ELECTRICAL MATERIALS, by S. Chaikin. Quarterly progress rept. no. 11, 1 Jan-31 Mar 57, on Contract DA 36-039-sc-64454. 30 Apr 57, 30p. 9 refs.
Order from LC mi$2.70, ph$4.80 PB 145 055

Contact contamination in sealed relays was studied chemically and particles and films were found. Outgassing of insulating materials used in sealed relays was investigated. Electrical leakage across glass hermetic seals in sealed capacitors may be caused by cracks in the glass. (Author) (See also PB 145 054)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON ELECTRICAL MATERIALS, by S. Chaikin. Quarterly progress rept. no. 12, 1 Apr-30 June 57, on Contract DA 36-039-sc-64454. 31 July 57, 8p. AD-200 596.
Order from LC mi$1.80, ph$1.80 PB 145 056

Because contact contamination in sealed relays can be caused by outgassing of organic insulation, this property of nine commercial magnet wire coatings was studied by measuring weight loss at 160°C in a nitrogen atmosphere. Over the 600-hr test period, Alkanex, Thermaleze, Celenamel, and Isonel showed the lowest weight losses, Siliclad and Sodereze the greatest, with Formvar, Nylclad, and Heavy Epoxy intermediate. (Author) (See also PB 145 055)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Final rept. for 1 July 54-15 Dec 57 on Contract DA 36-039-sc-64454. 15 Jan 58, 214p. 35 refs.
Order from LC mi$9.60, ph$33.30 PB 145 057

A chemical and electrical study has been carried out dealing with surface contamination of printed circuits and with silver migration. Printed circuit contaminants included fingerprints, etching and plating bath chemicals, solder fluxes and others. Factors accelerating silver migration were found to be temperature, relative humidity, and voltage. Susceptibility of various base materials were studied and many types of silver-bearing printed circuits were investigated. Methods of minimizing silver migration were found and a means of predicting its occurrence in a real situation was developed. (Author) (See also PB 145 056)

Sylvania Research Labs., Bayside, N. Y.
MEDIUM POWER VELOCITY SORTING DETECTOR. Final rept. on Contract AF 30(602)1588. 15 Oct 58, 71p. 1 ref. Rept. no. YD-58-3; AD-208 911.
Order from LC mi$4.50, ph$12.30 PB 138 590

Syracuse U. Research Inst., N. Y.
STUDY OF SYSTEM RELIABILITY, by F. M. Reza, A. Speth and S. Jutila. Technical rept. no. 1 on Contract AF 19(604)2452. June 58, 19p. 2 refs. SURI rept. no. EE 507-586T-1; AFCRC-TN-58-356; AD-160 799.
Order from LC mi$2.40, ph$3.30 PB 137 852

The present technical report covers the major work done on the project during our first year. The three main lines of study undertaken were: Part I - Study of the tolerance in systems; Part II - Redundant component networks; Part III - Equilibrium between disturbances and recoveries.

Transistor Applications, Inc., Boston, Mass.
INVESTIGATION OF THE APPLICATIONS OF NEGATIVE RESISTANCE DIODES FOR SWITCHING CIRCUITS, by A. W. Carlson and Robert E. McMahon. Final scientific rept. for 16 Mar 58-16 Sep 59 on Contract AF 19(604)3066. Sep 59, 29p. 5 refs. AFCRC-TR-59-352; AD-144 426.
Order from LC mi$2.70, ph$4.80 PB 144 426

This is the final report of work concerned with switching applications of semiconductor negative resistance devices. Work accomplished since the last scientific report included some multivibrator circuits using a tunnel diode and application of p-n-p-n diodes as core drivers. The work accomplished during the contract is reviewed and conclusions stated.

Mechanical Engineering

Bureau of Yards and Docks, Washington, D. C.
POWER GENERATION AND DISTRIBUTION. CHAPTER 6. CENTRAL HEATING PLANTS. CHAPTER 7. COMPRESSED AIR PLANTS. 15 July 54, 77p. Technical pub. NAVDOCKS TP-Pu-3.
Order from OTS $2.00 PB 161 358

Chapter 6 covers central heating plants and is primarily concerned with the design and maintenance of plants supplying steam for heating and industrial uses. Feed-water heating and pumps are described. The second half of the chapter covers maintenance, operation, and inspection of boilers, stokers, oil and gas burners, and heating plant auxiliaries; testing equipment and troubleshooting also are discussed, and methods of steam-pressure reduction are analyzed. Chapter 7 offers detailed information on the design, construction, operation, and maintenance of compressed air plants. This information covers the selection of compressors and auxiliary equipment, their application in the plants, and the design of the interconnecting piping for compressors and auxiliary equipment, as well as for vacuum services. Maintenance and operation of air compressors and auxiliary equipment, together with pertinent safety precautions and instructions, are outlined in the latter part of the chaper.

Bureau of Yards and Docks, Washington, D. C.
POWER GENERATION AND DISTRIBUTION. CHAPTER 8. ELECTRIC POWER DISTRIBUTION. 15 Oct 55, 156p. Technical pub. NAVDOCKS TP-Pu-3.
Order from OTS $3.50 PB 161 359

Chapter 7 offers detailed information on the design, construction, operation, and maintenance of compressed air plants. This information covers the selection of compressors and auxiliary equipment, their application in the plants, and the design of the interconnecting piping for compressors and auxiliary equipment, as well as for vacuum services. Maintenance and operation of air compressors and auxiliary equipment, together with pertinent safety precautions and instructions, are outlined in the latter part of this chapter.

Ordnance, Missiles, and Satellite Vehicles

Aeronutronic Systems, Inc. [Glendale, Calif.]
STUDY OF METHODS OF PRODUCING HIGH-SPEED PARTICLES, by T. Bergstralh, D. Kruciff and others. Final rept. on Contract AF 49(638)366. Nov 58, 68p. 20 refs. Pub. no. U-698; AFOSR-TR-59-181.
Order from LC mi$3.90, ph$10.80 PB 144 731

The aims of this research program were to: (1) Investigate methods for accelerating small particles with diameters in the range of 1 to 1000 microns to velocities of 5 to 10 km/sec. (2) Investigate methods for measuring the size and velocity of such particles. (3) Make measurements of the effects of particle impacts on various materials.

Air Force Cambridge Research Center, Bedford, Mass.
THE APPROXIMATE ANALYSIS OF ZERO-LIFT TRAJECTORIES, by C. P. Hoult. Aug 59, 27p. 27 refs. GRD Research Notes no. 17; AFCRC-TN-59-404.
Order from OTS $0.75 PB 161 340

The gross motion of a ballistic rocket following a zero-lift trajectory during both powered flight and re-entry is discussed with special reference to the importance of the appropriate dimensionless parameters. Approximate solutions are found for the tip-over maneuver, low- and high-altitude powered flight, and re-entry. Of the greatest significance to the rocket dynamicist is that all the above solutions are related to confluent hypergeometric functions which have been used to describe short-period motion in the literature. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
THE DETERMINATION OF SPACE ORIENTATION AND LENGTH OF AN ELONGATED OBJECT FROM SERIES OF LONG FOCUS PHOTOGRAPHS, by Heinrich J. Eichhorn. Rept. on Contract AF 08(606)1156. 4 Sep 59, 38p. RCA Data Processing Technical rept. no. 51; AFMTC-TR-59-19.
Order from LC mi$3.00, ph$6.30 PB 144 421

A method is developed to derive the kinematical parameters of a tumbling elongated object from either an isolated series of observations of this object's "body angles" and simultaneous observations of its azimuth and altitude as seen from one station, as well as from series of these data that were observed simultaneously at two separated stations. The theory is tested on and applied to the pass of the rocket of Sputnik III in the morning of 1958 September 11, which was observed from San Salvador and from Mayaguana. The methods developed for the One- and for the Two Station Solutions (both of which were

tried) yield practically identical results. The length of the aforementioned rocket was computed with a relative accuracy of 2.8% from data collected at the same pass.

Antenna Lab., Calif. Inst. of Tech., Pasadena.
ON SATELLITE TYPE ANTENNAS, by G. G. Weill and Cavour Yeh. Technical rept. no. 17 on Contract AF 18(600)1113. 30 Aug 58, 21p. 2 refs. AFOSR-TN-58-655; AD-162 186.
Order from LC mi$2.70, ph$4.80 PB 137 903

Using some previous study of the radiation of an antenna over a perfectly conducting sphere, various structures of antennas for space vehicles are discussed theoretically. The currents induced on the sphere are taken into account for the computation of radiation patterns. (Author)

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
PERFORMANCE CHARACTERISTICS OF THE ACCELERATION SWITCHING HYDRAULIC SERVO, by W. Seamone. Rept. on Contract NOrd-7386. Sep 58, 25p. 6 refs. CM-945; AD-208 258.
Order from LC mi$2.70, ph$4.80 PB 144 719

The acceleration switching technique has been found to enhance hydraulic servo system performance for applications requiring precision and reliability over a wide range of load and environmental conditions. This paper discusses static and dynamic performance of a switching-type system and shows where performance is improved over the equivalent linear flow-control servos. Operation of acceleration switching servos under adverse environmental conditions shows little degradation of system performance. (Author)

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
EVALUATION OF SIGHTING DEVICES FOR A SMALL HAND-HELD ROCKET LAUNCHER, by Harold T. Curran, Jr., Robert T. Gschwind and others. Sep 59, 21p. 6 refs. Technical memo. 6-59.
Order from LC mi$2.70, ph$4.80 PB 144 542

This study investigated the degree of difference in accuracy due to aiming error between three types of experimental sighting devices: An iron sight with a twenty inch sight radius utilizing a plexiglass plate upon which a reticle was etched for the front post (Sight "A"), a unity-power optic using singlet lenses (Sight "B"), and a unity-power optic using doublet lenses (Sight "C"). Twenty-eight Infantry men from Fort Dix, New Jersey were used as subjects. Greater accuracy will be attained with Sight "C" than Sight "B", and Sight "B" will yield better performance than Sight "A". Determinants of qualitative disparity between the sights, and possible effects of low illumination sighting are discussed.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE CALCULATION OF MAXIMUM ORDINATE OF AN A-4 ROCKET FROM THE CONDITIONS AT BURNOUT, by Virginia M. Reklis and C. Ronald Cassity. Feb 48, declassified, 43p. Rept. no. 655.
Order from LC mi$3.30, ph$7.80 PB 144 809

In Part I standard formulae are given for the determination of the maximum ordinate of an A-4 rocket (or any long time-of-flight missile). A practical example, A-4 round 12, is given as illustration. The variation of the force of gravity with altitude and the rotation of the earth have been taken into account. In Part II the formulae have been adjusted to a series from more adaptable to quick computation. For expediting the determination of maximum ordinates of future missiles tables are presented giving the maximum altitudes with corresponding times-of-flight after burnout as functions of the areal velocity, the vertical component of velocity and altitude at burnout. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
DOPPLER DETERMINATION OF POSITION, by Boris Garfinkel. 11 Apr 47, 14p. 1 ref. Rept. no. 638.
Order from LC mi$2.40, ph$3.30 PB 145 061

The problem of determining the position of a missile from three simultaneous radio-doppler observations has been treated by S. Kusaka. A new method of solution described here shortens the computations and improves the accuracy of the results. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
DOPPLER DETERMINATION OF PROJECTILE TRAJECTORY, by Shuichi Kusaka. May 46, 9p. Rept. no. 609.
Order from LC mi$1.80, ph$1.80 PB 145 063

For the determination of the trajectory of a projectile by means of a radio transmitter and three receivers, formulae are given for the coordinates of the projectile in terms of the observed quantities. Formulae are derived for the general case and two special cases are considered. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
FULL-SCALE FREE-FLIGHT BALLISTIC MEASUREMENTS OF AIRCRAFT ROCKETS BY OPTICAL METHODS, by Dirk Reuyl. 15 June 48, declassified. 63p. 5 refs. Rept. no. 676.
Order from LC mi$3.90, ph$10.80 PB 144 805

Optical methods of full-scale free-flight ballistic measurements of aircraft rockets are described briefly. A series of photographs is included to illustrate the methods. The methods are applicable to other projectiles as well. Also they may be readily modified to serve in the ballistic studies of ground rockets and other missiles in free flight. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
TRACKING TELESCOPE FUNDAMENTALS, by James B. Edson. 23 Aug 48. 25p. 1 ref. Rept. no.

672.
Order from LC mi$2.70, ph$4.80 PB 144 803

This report assembles a foundation of simple basic information useful in the design and operation of tracking telescopes. Some topics discussed are: Appearance of the missile compared to planets; conditions for optimum missile visibility; telescope size requirements; effects of the atmosphere; station site selection; tracking and photographic techniques. Construction and installation at White Sands Proving Ground of the first tracking telescope is described. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
TRAJECTORY OF THE ROCKET A-4 DURING BURNING OBSERVED BY MITCHELL PHOTOTHEODOLITES, by H. P. Hitchcock and V. M. Reklis. 16 Oct 47, declassified. 54p. 1 ref. Rept. no. 639.
Order from LC mi$3.60, ph$9.30 PB 144 808

The method of observing the Rocket A4 at White Sands Proving Ground with two Mitchell phototheodolites, measuring the film, and reducing the data is explained. The trajectory data obtained for rounds 3 to 17 are presented and the results analyzed briefly from a ballistic point of view, as well as from the point of view of their accuracy. (Author)

Carnegie Inst. of Tech., Pittsburgh, Pa.
RE-EXAMINATION OF THE THEORIES OF JET FORMATION AND TARGET PENETRATION BY LINED CAVITY CHARGES, by R. J. Eichelberger. Rept. on Contract DA 36-061-ORD-394. June 54, 128p. 25 refs. CEL rept. no. 1.
Order from LC mi$6.30, ph$21.30 PB 144 831

Diamond Ordnance Fuze Labs., Washington, D. C.
ARMING ASSEMBLY, BOMB FUZE: TAIL T46E1 AND SHAFT, DRIVE, FUZE ARMING, T7E1, T8E1, AND T9E1, by Charles N. Whelan. Terminal rept. 10 Nov 59, 16p. 3 refs. TR-770.
Order from LC mi$2.40, ph$3.30 PB 144 704

The research and development and the production engineering of the Arming Assembly, Bomb Fuze: tail T46E1, and the Shaft, Drive, Fuze Arming T7E1, T8E1, and T9E1 have been completed. The arming assembly was developed to arm the M905 (T771), M906 (T788), and T787 mechanical bomb tail fuzes when installed in conical-fin general purpose bombs. The drive shafts have been given separate Federal Item Identifications because a different length shaft is required for each of the three bomb fin assemblies (M128A1, M129, and M130) on which the arming assembly is to be used. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
A SELF-CONTAINED MECHANICAL RECORDING ACCELEROMETER, by George Blagman. 1 July 59, 22p. 3 refs. TR-703; AD-228 747.
Order from LC mi$2.70, ph$4.80 PB 144 708

A mechanical recording accelerometer has been developed to measure firing or impact accelerations in non-rotated projectiles or rockets. The instrument is small, rugged, and self-contained, requiring no outside power, no external triggering, and no telemetry. The sensing and recording mechanism can be adapted to measurement of impulses up to 5000 g over periods up to 30 msec. A record of acceleration magnitude versus time is provided with an accuracy of ±10 percent of peak values. The record is permanent and readily interpreted. Field tests of the instrument in an 81-mm mortar shell were successful. The instrument can be reused after recovery. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
A TRANSDUCER INFORMATION PROGRAM FOR ORDNANCE, by J. Pearlstein. 1 Oct 59, 43p. 16 refs. TR-752; AD-227 969
Order from LC mi$3.30, ph$7.80 PB 144 409

An Ordnance Transducer Research Project has been established at DOFL in accordance with OTCM 36576. The requirements set forth in the OTCM were studied against a background of information from a limited number of sources in order to plan an effective program for conducting the project. The results of this study are summarized below: (1) The principles involved in the design, performance, and evaluation of transducers cut across all the fields of physical science and engineering. (2) Ordnance activities are coextensive with all these fields. (3) A central problem of the project - the documentation of the results of scientific research and technology, involving the elements of selecting, classifying, storing, searching, retrieving, and communicating information - must be given continued study. (4) It is proposed to adopt a "multiaspect" documentation system similar to the "Peek-a-Boo" system employed by the Office of Basic Instrumentation of the National Bureau of Standards for coverage of the scientific literature. (5) A simple 5 in. x 8 in. card index will be used for commercially available transducers.

Director of Defense Research and Engineering, Washington, D. C.
TECHNICAL RESOURCES DIRECTORY: MISSILE GROUND SUPPORT EQUIPMENT. 1 Nov 59, 22p.
Order from OTS $0.50 PB 161 103

Through its extensive research and engineering programs, the Department of Defense is developing material and equipment designed to meet present and future military requirements. The diverse tasks embraced in these programs range throughout the broad scope of military activities. This directory of military technical resources is intended to encourage communication in the Military Departments and in industry in the area of ground support equipment for missile systems.

Feltman Research and Engineering Labs., Picatinny Arsenal, N. J.
LEAD AZIDES FOR USE IN DETONATORS, by Robert L. Wagner. Jan 60, 38p. 23 refs. Technical rept. 2662.
Order from LC mi$3.00, ph$6.30 PB 143 938

During the development of a short detonator (M47) for use in 20 mm ammunition it became evident that as smaller fuzes were made, more efficient explosives for use in initiators would be needed. To meet such a need several different types of lead azide were investigated as possible replacements for the standard dextrinated lead azide covered by Military Specification MIL-L-3055. The types of lead azides investigated include dextrinated, RD-1333, polyvinyl alcohol (PVA), British Service, colloidal, and dextrinated colloidal. A minimum of 25 mg RD-1333 lead azide or 30 mg PVA lead azide was required to initiate RDX in the M47 detonator as compared with 90 mg for dextrinated lead azide. Neither RD-1333 nor PVA was hygroscopic, but dextrinated lead azide picked up over .5% moisture in 35 minutes at 82%-92% relative humidity. RD-1333, PVA, British Service, colloidal, and dextrinated colloidal lead azide had impact sensitivities of 5, 4-5, 2, 2, and 3 inches, respectively, using the 2-kg weight, as compared with 4-6 inches for dextrinated lead azide.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
PRODUCT ENGINEERING TO IMPROVE MATERIALS AND DESIGN MODIFICATION OF FIBER CONTAINERS AND HERMETICALLY SEALED CONTAINERS (6046-90, 91, 92, 93), by Theodore Fruchtman. Oct 59, 7p. Final engineering rept. FR: 3-60.
Order from LC mi$1.80, ph$1.80 PB 144 744

Under this Project work was done on a variety of items and subdivisions. This report summarizes the work, item by item.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
THE T36E1 STEEL-WOOL WHITE-PHOSPHORUS (SWP) SMOKE GRENADE, by Leo F. Young and William M. Conway. Nov 59, 33p. 9 refs. Technical rept. 2618.
Order from LC mi$3.00, ph$6.30 PB 144 743

A smoke grenade which can be projected from combat vehicles for concealment has been developed. Designated the T36E1, it contains a white phosphorus smoke charge in which steel wool is used to prevent excessive spread of the smoke cloud.

General Electric Co., Schenectady, N. Y.
ACCELERATION CHARACTERISTICS OF THE HERMES B-1 RAMJET TEST VEHICLE, by W. F. Dankhoff and L. H. Edelfelt. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 21 Sep 49, declassified 17 Nov 58, 16p. 1 ref. Technical information series no. DF-49-GL-153.
Order from LC mi$2.40, ph$3.30 PB 144 627

This report presents the results of an investigation to determine the effect of air-fuel ratio and altitude upon the acceleration characteristics of the Hermes B-1 test vehicle between the Mach numbers of 2.9 and 4.0.

General Electric Co., Schenectady, N. Y.
AERODYNAMIC EVALUATION OF HERMES A-3A ROUNDS #1 AND #2, by O. Klima, Jr. and R. E. Geiger. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 7 Oct 53, declassified 17 Mar 58, 8p. 4 refs. Technical information series no. DF 53A0654.
Order from LC mi$1.80, ph$1.80 PB 144 609

The results of a preliminary aerodynamic analysis of Rounds #1 and #2 made to correlate the aerodynamic behavior of the missile with the predicted behavior as obtained from wind-tunnel test results are presented herein.

General Electric Co., Schenectady, N. Y.
ALTERNATIVE NAVIGATION SYSTEM SIMILAR TO 84 MINUTE PENDULUM SYSTEM, by A. P. Adamson. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. Jan 53, declassified 17 Mar 58, 7p. Technical information series no. DF 53A0500.
Order from LC mi$1.80, ph$1.80 PB 144 620

A slight method of mechanization of 84 minute pendulum navigation system is presented. Alternate methods of mechanization of 84 minute pendulums are possible and should be investigated. (See also PB 144 623)

General Electric Co., Schenectady, N. Y.
ANALYSIS OF WING TEMPERATURE AT VARIOUS POINTS-SKIN ONLY, by W. W. Fischer. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. Nov 50, declassified 17 Mar 58, 77p. 4 refs. Technical information series no. DF 50A0517.
Order from LC mi$4.50, ph$12.30 PB 144 631

A proposed wing for the Hermes B-1 utilizing biconvex configuration, monocoque type construction has been analysed for temperature distribution during the first three minutes after takeoff from the ground. Steel and titanium sheet materials with various surface treatments were considered.

General Electric Co., Schenectady, N. Y.
DAMPED 84 MINUTE PENDULUM NAVIGATION SYSTEM, by A. P. Adamson. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. Jan 53, declassified 17 Mar 58, 11p. Technical information series no. DF 52A0667.
Order from LC mi$2.40, ph$3.30 PB 144 617

A method for damping an 84 minute pendulum navigation system is discussed. The method involves the use of doppler velocity data in addition to the usual inertial data. The method discussed is operable but, in many cases, not advantageous.

General Electric Co., Schenectady, N. Y.
DESIGN OF INTERIM TACTICAL ANTENNA MOUNT PER SPEC. OST 3039, by B. Wilbur. Rept. on Project [Hermes] Contract [DA 30-115-ORD-23]. 23 Sep 53, declassified 13 May 58, 86p. Technical information series no. DF-53A0401.
Order from LC mi$4.80, ph$13.80 PB 144 618

Design incomplete at time of U. S. Government cancellation of contract. Status of design, reasons for basic features, are shown, with photos of model and main layouts.

General Electric Co., Schenectady, N. Y.
DEVELOPMENT PROPOSALS OF THE PROPULSION SUB-SECTION OF PROJECT HERMES. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 22 Jan 54, declassified 25 Dec 58, 69p. 3 refs. Technical information series no. DF54A0510.
Order from LC mi$3.90, ph$10.80 PB 144 614

This study was created to furnish a collecting point for ideas which have been suggested as deserving further study. Some of these ideas are practical and immediately applicable, others are unproved. The ideas outlined in this study are aimed toward bi-propellant rockets with some comparison to hybrid-types included.

General Electric Co., Schenectady, N. Y.
EIGHTY-FOUR MINUTE PENDULUM, by A. P. Adamson. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 14 Feb 52, declassified 17 Mar 58, 19p. Technical information series no. DF 52A0517.
Order from LC mi$2.40, ph$3.30 PB 144 623

This report discusses the methods and the physical picture involved in calculating the characteristics of an "84 minute pendulum", a term describing a certain class of navigational devices. Includes the description, an analysis, and a discussion of error in the system. The system as described can have many sources of errors. A preliminary investigation indicates that the stabilizers tried for damping the device and eliminating the oscillatory would seem to make the steady state reponse errors larger. Further study of the investigations done by other organizations should be done. (See also PB 144 617)

[General Electric Co., Schenectady, N. Y.]
EXPERIMENTAL NORMAL FORCE COEFFICIENT AND CENTER OF PRESSURE FOR SIMULATED STICK-FREE CONDITIONS OF PROPOSAL VII; AND PROPOSAL VII_{10}, by John O. Powers. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 1 Aug 52, declassified. 8p. Hermes A-2 Aerodynamic data memo. no. 20C.
Order from LC mi$1.80, ph$1.80 PB 144 612

Hermes A-2 Aerodynamic Specification Memorandum #20B presented a theoretical estimate of the approximated variation of stick-free normal force coefficient and center of pressure as a function of Mach number for the Proposal VII configuration. The present memorandum (20C) presents the experimental values of these parameters as obtained by recent supersonic wind-tunnel tests at the Aberdeen Proving Ground and the Jet Propulsion Laboratory. Experimental values are also presented for a Proposal VII type configuration modified by a 10% increase in each of the fin dimensions. This configuration is here denoted as Proposal VII_{10}.

General Electric Co., Schenectady, N. Y.
GIMBAL GEOMETRY AND SERVO ANALYSIS FOR HA3B ODOMETER, by J. D. M. Cameron. Rept. on Project [Hermes] Contract [DA 30-115-ORD-23]. 27 May 53, declassified 17 Mar 58, 19p. Technical information series no. DF53A0593.
Order from LC mi$2.40, ph$3.30 PB 144 621

Report contains gimbal geometry analysis, which, when combined with gimbal servo equations, leads to differential equations that can be solved for table position errors as functions of time if missile angular velocities are known. Appendices contain pertinent trigonometric identities, discussion of Euler angular velocities, and a sample calculation.

[General Electric Co., Schenectady, N. Y.]
HA-2 TRIM CHARACTERISTICS WITH TRAILING-EDGE BARS AS CONTROLS (XSSM-A-13), by John O. Powers. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 4 Oct 52, declassified 28 May 58, 8p. Hermes A-2 Aerodynamic data memo. no. 10G.
Order from LC mi$1.80, ph$1.80 PB 144 613

The configuration considered in this memorandum differs from other configurations in the Hermes Aero. Data Memo. #10 Series in that the flap type controls have been replaced by a new type of aerodynamic control. The previous memos in the #10 series remain valid for the configurations there considered.

General Electric Co., Schenectady, N. Y.
HERMES A-3B INERTIAL AZIMUTH GUIDANCE, by A. P. Adamson. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 7 Apr 52, declassified 17 Nov 58, 13p. Technical information series no. DF 52A0535.
Order from LC mi$2.40, ph$3.30 PB 144 626

A discussion of the possibility of using an inertial guidance system for the HA3B azimuth control and an analysis of the performance which might be expected from such a system. Inertial control for the HA3B azimuth control is sufficiently attractive so that it should be studied carefully and immediately since it may provide a means whereby the guidance system maybe greatly simplified. The two major problems to be investigated are: (a) What gyro drift rate must be expected in the missile. (b) How can the azimuth odometer be aligned before takeoff.

General Electric Co. [Schenectady, N. Y.]
HINGE MOMENT, NORMAL FORCE, AND CENTER OF PRESSURE OF THE FINS EXCLUDING FIN EFFECT ON THE BODY, by Helen C. Engvold and Otto Klima, Jr. 30 Mar 53, 6p. 2 refs. Hermes A-3A Aerodynamic Data Memo. 44B.
Order from LC mi$1.80, ph$1.80 PB 144 353

This memorandum replaces memoranda 44 and 44A and may be used to estimate the hinge moments for the Hermes A-3A missiles through #8. Preliminary subsonic wind-tunnel tests results at NACA Langley Laboratory on a model of the Hermes A-3B

and free-flight tests of a somewhat similar fin taken from reference 2 have made it possible to further refine the previous estimates. A more rigorous subsonic analysis of the effect of angle of attack α and angle of fin deflection, δ, (on C_h C_z, and center of pressure of the fin force than has been made here will be made on the Hermes A-3B when the final NACA Langley tests are available. The normal-force coefficients given in this memorandum include only the actual force on the fins and do not include the effect of the fin on the body; hence they should not be used in trim calculations. Fin forces given in memorandum #3D remain valid for trim calculations. The effects of fin elastic deflections on hinge moments are not included in this memo. Although it is probably not necessary to evaluate these aeroelastic effects for the success of A-3A flights through #8, they will be needed to apply the hinge moment results from the A-3A firings to the Hermes A-3B. Without a knowledge of aeroelastic affects, the hinge-moment measurements that are to be made on the A-3A full-scale missiles (to aid in determining the maximum hinge moments expected on the Hermes A-3B) will be of little use. The Douglas people are presently evaluating these A-3A aeroelastic effects for Mach numbers above 2.0. It does not appear practicable to evaluate these below M = 2 except by full-scale flight test, where results with high and low dynamic pressure, q, may yield a significant comparison.

General Electric Co., Schenectady, N. Y.
INERTIAL GUIDANCE SYSTEM FOR HERMES A2, by A. P. Adamson. Rept. for 1 Mar 51-1 Mar 52 on Project Hermes, Contract [DA 30-115-ORD-23]. 1 Mar 52, declassified 25 Dec 58, 7p. Technical information series no. DF-51A0516.
Order from LC mi$1.80, ph$1.80 PB 144 622

Some of the development problems which must be solved in this data folder are listed. An inertial guidance system should be technically possible for Hermes A-2. Such a system would have military advantages and its development should be carried out as soon as possible.

General Electric Co., Schenectady, N. Y.
INERTIAL GUIDANCE SYSTEMS, by A. P. Adamson. Rept. on Project Hermes [Contract DA 30-115-ORD-23]. Oct 51, declassified 17 Mar 58, 17p. Technical information series no. DF 51A0524.
Order from LC mi$2.40, ph$3.30 PB 144 615

An inertial guidance system which might be suitable for Hermes A-2 and Hermes A-3 guidance is considered. The primary aim is to determine whether such a system is feasible and to explain its operation and characteristic so they are easy to understand. The system discussed seems feasible and reasonably simple though quite accurate inertial elements are needed.

[General Electric Co., Schenectady, N. Y.]
NORMAL FORCE COEFFICIENT AND CENTER OF PRESSURE WITH ZERO ELEVATOR DEFLECTION PROPOSAL VII, by Richard E. Geiger. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 10 Sep 52, declassified. 3p. Hermes A-2 (XSSM-A-13) Aerodynamic data memo. no. 21B.
Order from LC mi$1.80, ph$1.80 PB 144 610

This memorandum supersedes A-2 Aero. Spec. #21A. It presents a revision of the Proposal VII stick-fixed (i.e. undeflected elevator) normal force and center of pressure previously presented in that memo. The revision is based on supersonic wind-tunnel tests of the complete configuration. Memo. #21A was based on linearized theory with modified bare body test data.

General Electric Co., Schenectady, N. Y.
PRELIMINARY A4, B-1 TRAJECTORY, by F. Fay. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 18 May 50, declassified 17 Nov 58, 16p. Technical information series no. DF 50A0509.
Order from LC mi$2.40, ph$3.30 PB 144 628

A trajectory is presented here for the A-4, B-1 (wingless) combination. The A-4 (German) is used as a booster to deliver the Hermes B-1 ramjet to the specified launching conditions of : Mach No. — 4.0, Missile Attitude— 20° (from horiz.), Altitude— 60,000 ft.

General Electric Co. [Schenectady, N. Y.]
ROLL MOMENT DUE TO FIN DEFLECTION AND AEROELASTIC EFFECTS, by Otto Klima, Jr. and Patricia A. Gill. 10 Mar 53, declassified. 2p. Hermes A-3A Aerodynamic Data Memo. 39A.
Order from LC mi$1.80, ph$1.80 PB 144 354

This memorandum is based on recent wind-tunnel test results of the Hermes A-3B adjusted to apply to the Hermes A-3A. An approximation of the aeroelastic effects is also included. The effect of the jet vane on roll moment is not included. This moment may be calculated using Memoranda 16C and 16E.

[General Electric Co., Schenectady, N. Y.]
ROLL MOMENT DUE TO NONSYMMETRY, by O. Klima, Jr. 10 Mar 53, 1p. Hermes A-3A Aerodynamic Data Memo. 39B.
Order from LC mi$1.80, ph$1.80 PB 144 355

Hermes A-3A Aerodynamic memo #39A should be used for rudder effectiveness in roll. In addition to the roll moment caused by fin deflection a nonsymmetrical attitude of the missile to the air flow, resulting from a roll angle and an angle of attack, also introduces a roll moment. This roll moment varies as the fourth power of the angle of attack but is not appreciable at angles below 10°. Since the A-3A missiles through number 8 will probably not experience angles of attack much larger than 10°, this nonsymmetrical roll study will not be continued on the A-3A. If the free flight shoots of the A-3A reveal roll difficulties this nonsymmetrical effect can be investigated at that time using Hermes A-3B wind tunnel test results. The report is here quoted in its entirety.

General Electric Co., Schenectady, N. Y.
S1 DIGITAL COMPUTER, by T. R. Green. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 29 Apr 52, declassified 17 Mar 58, 29p. Technical information series no. DF 52A0545.
Order from LC mi$2.70, ph$4.80 PB 144 616

Part I of this report develops a theory for determining by digital computer the four corrections, range and azimuth displacement, azimuth velocity, and time correction for initiating terminal straight line flight. This part also contains a computer flow diagram. Part II introduces dimensional analysis for displacement, range, desirable parameters, as well as pulse values. Average error is in the order of 64 feet. This error lowered to 42 or 31 feet with additional adjustment as described in the general introduction.

General Electric Co., Schenectady, N. Y.
SKIN TEMPERATURE AND COOLING ANALYSIS OF THE COMBUSTION CHAMBER WALL AND NOZZLE OF THE HERMES B-1 VEHICLE, by I. H. Edelfelt and N. C. Witbeck. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. Oct 48, declassified 17 Mar 58, 12p. 6 refs. Technical information series no. DF-49-GL-65.
Order from LC mi$2.40, ph$3.30 PB 144 607

The transient and equilibrium temperatures of the Hermes B-1 combustion chamber and exhaust nozzle are calculated for design flight conditions. The resultant temperatures indicate that some means of nozzle cooling is required to prevent tailpipe burnout. Two means of nozzle cooling are investigated theoretically; namely, air cooling by annularly ducted ram air, and protection by means of fuel additives. It is found that the two methods in combination will prevent equilibrium temperatures from exceeding 1800° F.

[General Electric Co., Schenectady, N. Y.]
STATIC STABILITY MARGIN FOR ROUNDS 1-4 (NEAR VERTICAL TRAJECTORY), by O. Klima, Jr. and S. K. Hellman. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 26 Aug 52, declassified. 5p. 4 refs. Hermes A-3A Aerodynamic data memo. no. 14A.
Order from LC mi$1.80, ph$1.80 PB 144 619

This memorandum supplements Aero. Spec. Memo. 14. It gives the possible range of static stability margin for the A-3A missile during the powered flight portion of Rounds 1-4 (near vertical trajectory). The static stability margin given in this memorandum is based on the most recent center-of-pressure results for the complete missile as presented in memorandum 24E and includes calculated effects of elasticity, air temperature effects, and tolerances on center of gravity and center of pressure locations. All this data is for the near-vertical power-on trajectory of the first four rounds of the A-3A.

General Electric Co., Schenectady, N. Y.
SUMMARY OF A4, B-1 TRAJECTORIES, by F. Fay. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. [1950] declassified 17 Mar 58, 47p. Technical information series no. DF 50A0514.
Order from LC mi$3.30, ph$7.80 PB 144 630

The results of a number of Hermes A-4, B-1 trajectories are included with a brief resume of the general purpose of each. For reference the trajectories have been given Roman numerals corresponding to their chronological order. On the following page a plot of each has been made in x-y coordinates. In trajectories I and II a modified A4 was used as a booster. This is the same A4 that was incorporated in the Hermes II Ram and is designated here as A4 (modified). A standard A4 was assumed for trajectories III, IV, and V.

General Electric Co., Schenectady, N. Y.
SUMMARY OF HERMES B-1 TEST VEHICLE DRAWINGS, by K. I. Igler. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. Sep 50, declassified 17 Mar 58, 20p. Technical information series no. DF 50A0510.
Order from LC mi$2.40, ph$3.30 PB 144 629

[General Electric Co., Schenectady, N. Y.]
SUPERSONIC ELEVATOR NORMAL FORCE - PROP. VII, by R. E. Geiger. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 9 Oct 52, declassified. 7p. Hermes A-2 Aerodynamic data memo. no. 17F.
Order from LC mi$1.80, ph$1.80 PB 144 611

This memorandum presents supersonic elevator normal force characteristics for the Proposal VII configuration. It supplements the previous memos of this series which remain valid for their respective configurations. During April, 1952 an experimental investigation of the supersonic elevator normal force characteristics of the Hermes A-2, Proposal VII configuration was conducted at the Aberdeen Proving Ground. The test data have been reduced and the elevator normal-force characteristics calculated. This memorandum presents the results of these computations.

General Electric Co., Schenectady, N. Y.
TRANSIENT TEMPERATURE OF INTRA-WING ANTENNA LEAD, by W. W. Fischer. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. Dec 50, declassified 25 Dec 58, 19p. 3 refs. Technical Information series no. DF 50A0520.
Order from LC mi$2.40, ph$3.30 PB 144 632

The transient temperature of a proposed antenna lead between the wing skins has been calculated for two possible conditions. For flight times of more than two minutes duration, after separation from the A4 booster, a rigid co-axial antenna lead must be used to prevent failure of the lead. Aluminum tube with ceramic spacers for the inner conductor would provide a satisfactory arrangement for flight times up to 8 minutes. Supports for the lead should be minimized both in quantity and cross-sectional area and be made of thermally non-conducting, heat-resistant material.

[General Electric Co., Schenectady, N. Y.]
TRIM NORMAL-FORCE COEFFICIENT AND ELEVATED DEFLECTION FOR TRIM FOR COMPLETE MISSILE — PROPOSAL VII, by R. E. Geiger. Rept. on Project Hermes, Contract [DA 30-115-ORD-23].

16 Sep 52, declassified. 7p. 3 refs. Hermes A-2 (XSSM-A-13) Aerodynamic data memo. no. 10E.
Order from LC mi$1.80, ph$1.80 PB 144 608

This memorandum which supersedes Memorandum 10D, presents revised supersonic trim normal force and elevator deflections for the Proposal VII configuration as described in Hermes A-2 Aerodynamic Data Memoranda 20B and 10D. The revision is based on supersonic wind-tunnel tests of the complete configuration. The data previously presented in Memo 10D were based on theory and modified bare-body test data.

High Altitude Observatory, Boulder, Colo.
SCIENTIFIC REPORT NO. 1, by James W. Warwick. Rept. for 14 Apr-13 July 58 on Contract AF 19(604)3872. 1 Oct 58, 21p. 5 refs. AFCRC-TN-58-392; AD-160 848.
Order from LC mi$2.70, ph$4.80 PB 137 796

A secular change took place in the spin-fading rate during the three weeks of observation of the radio transmissions from Sputnik I, between 4 Oct and 24 Oct 57. This effect allows a determination of atmospheric density near the perigee point. For an assumed atmospheric scale height of 30 kilometers, we derive a value 3.8×10^{-13} gm. cm^{-3} for the density at 220 kilometers. Some fluctuations in the spin decay appear to be real, and may result from small changes in the orientation of the spin axis within the satellite. An alternative interpretation, in terms of charged drag resulting from motion of the satellite through the ionospheric plasma, requires a charge of at least 10^4 volts on the satellite. This charge might be acquired in the auroral zone.

Massachusetts Inst. of Tech., Cambridge.
ORDNANCE LOGISTICS STUDIES. II. SECONDARY ITEM SUPPLY CONTROL, by Herbert P. Galliher. Interim technical rept. no. 9 on Fundamental Investigations in Methods of Operations Research, Contract DA 19-020-ORD-2684. Aug 58, 99p. 2 refs.
Order from LC mi$5.40, ph$15.30 PB 138 575

This is a further report of an operations research study being conducted for the Field Service Division of the Office of the Chief of Ordnance. The general objective of the study has been to develop improved decision-rules for controlling stocks of secondary items (primarily repair parts), especially in respect to the incidence of stock-shortages, the size of inventories and the costs of stocking and replenishment.

Naval Ordnance Lab., White Oak, Md.
TEMPERATURE MEASUREMENT WITH LEAD SULFIDE CELLS, by W. W. Scanlon, L. G. Mundie, and P. W. Shadle. 20 Mar 50, 12p. NOLM 10830.
Order from LC mi$2.40, ph$3.30 PB 145 030

With lead sulfide cells it is possible to measure quickly and accurately the skin temperature of an object from room temperature to 400° or 500°C provided care is taken to standardize the surface emissivity. Temperatures which exist for one or two seconds can be measured with an accuracy of ±0.22°C at 30°C, and ±0.02°C at 80°C. Temperatures which exist for only a few tens of microseconds can be measured with accuracies of ±8°C at 160°C and ±2°C at 210°C. (Author)

Naval Research Lab., Washington, D. C.
THE INFLUENCE OF TEMPERATURE ELEVATION ON THE PENETRATION OF MISSILES INTO COPPER TARGETS, by W. J. Ferguson and K. R. McKinney. Interim rept. 19 Nov 59, 14p. 2 refs. NRL rept. 5407.
Order from LC mi$2.40, ph$3.30 PB 143 406

One-eight-inch-diameter tungsten carbide spheres were fired into thick copper targets at room temperature and at 800°F at velocities from less than 1000 to 5000 ft/sec. It is shown that the depth of penetration, crater diameter, and volume of target material displaced increase as a consequence of the elevation of the temperature. The depth of penetration of the missile and the volume of target material displaced are essentially independent of cracking and breakup of the missile until extensive fracturing makes it impossible to ascertain from visual observation that the missile was probably spherical. (Author)

Picatinny Arsenal, Dover, N. J.
ENGINEERING OF EQUIPMENT FOR MASS PRODUCTION OF M9 MORTAR PROPELLANT, by F. A. Handville. Dec 59, 30p. 3 refs. Technical rept. DB-TR: 2-60.
Order from LC mi$2.70, ph$4.80 PB 144 738

Studies were conducted which indicated the feasibility of using ball powder as a replacement or alternate to M9 flake propellant both for the ignition charge and for the propellant increments for the Cartridge, HE, M362 for the 81 mm mortar.

Picatinny Arsenal, Dover, N. J.
AN ULTRASONIC METHOD FOR THE ACCEPTANCE TESTING OF TUNGSTEN CARBIDE CORES (PHASE I), by David Stein. Nov 58, 18p. 2 refs. Technical rept. DE-TR: 8-58; AD-207 673.
Order from LC mi$2.40, ph$3.30 PB 138 508

Size and location of defect indications observed ultrasonically correlated consistently with the general size and location of flaws revealed by sectioning or fracture of cores. The test results indicated that ogive flaws may be more critical in determining ballistic behavior than body flaws.

Stanford Research Inst., Menlo Park, Calif.
THE STUDY OF ROCKET SLED SLIPPER WEAR PROBLEMS, by J. S. Arnold, T. D. Witherly, and C. T. Vincent. Rept. on Contract AF 29(600)1516. Oct 59, 59p. 2 refs. AFMDC-TR-59-38.
Order from LC mi$3.60, ph$9.30 PB 144 595

In the use of rocket-propelled track vehicles, the wear of the sliding bearing (slipper) which is the contact between the vehicle and the track has sometimes led to component failures. Methods of reducing

this wear include the use of track coatings and wear-resistant slipper materials. Four metal coatings (aluminum, lead, zinc, and tin babbitt) were tested with stainless steel and molybdenum sliders on the AFMDC track (Holloman Air Force Base) at 2500 ft/sec for 2000 ft. Of these coatings, zinc was the most effective and reduced the wear rate of the slipper material to approximately one-fifth that observed on the bare rail, a reduction well within the problem specification. Two nonmetallic coatings,

Utah U., Salt Lake City,
PROPAGATION CHARACTERISTICS OF DETONATION GENERATED PLASMAS, by L. L. Udy. Rept. on Contract AF 18(603)100. 20 June 58, 35p. 6 refs. AFOSR-TN-58-754; AD-201 613.
Order from LC mi$3.00, ph$6.30 PB 138 177

Electrical conduction measurements were made in the highly ionized plasma region produced by detonating high explosives. The plasma was determined to originate directly from reaction of the high explosive rather than from thermal ionization associated with the accompanying shock wave. The mechanism of conduction was considered, and it was shown that electron flow through the plasma accounted for practically all of the current.

Watertown Arsenal Labs., Mass.
MAGNETIC INSPECTION OF PROJECTILES BY INDUCTION TECHNIQUES, by Patrick C. McEleney and Vincent H. Early. Rept. on Improved Magnetic Inspection Control Procedures. Nov 59, 18p. 1 ref. WAL TR-145/18.
Order from OTS $0.50 PB 161 328

An Automatic Flaw Detector for projectiles utilizing the magnetic induction method for inspection of high explosive shell bodies and armor-piercing shot of sizes 75mm through 120mm. This report discusses over-all principles of operation, explains electromechanical and electronic circuits, defines present status of equipment and makes recommendations for future work.

Sanitation and Safety Engineering

Bureau of Yards and Docks, Washington, D. C.
INSTALLATIONS--GENERAL. INSECT AND RODENT CONTROL. 1 Feb 56, 176p. Technical pub. NAVDOCKS TP-Pu-2, supersedes issue of 15 May 53; Air Force Manual no. 85-7; Army Technical manual no. 5-632, superseded issue of 7 Oct 47.
Order from OTS $3.00 PB 161 357

This manual discusses the control of insects, rodents, and other pests at Department of Defense installations. Special emphasis is placed on the supervision and execution of measures recommended for the control of pests that affect the health, efficiency, and morale of those residing at installations, or that damage and destroy property, including stockpiles of supplies. Measures include water management for mosquito control, termiteproofing, ratproofing, chemical treatment of wood and soil, fumigation of commodities, application of residual and other types of sprays, application of insecticidal dusts, and trapping and baiting for rodent control. Included among pests that must be controlled are: mosquitoes, flies, fleas, lice, ticks, chiggers, bed bugs, cockroaches, foliage-feeding insects, scale insects, aphids, stored-product pests, termites, wood borers, fungi, rats, mice, field rodents, and predatory animals.

Naval Radiological Defense Lab., San Francisco, Calif.
FEASIBILITY AND APPLICABILITY OF ROOF WASHDOWN SYSTEM, by W. S. Kehrer and M. B. Hawkins. 7 May 58, 42p. 12 refs. Research and development technical rept. USNRDL-TR-232.
Order from LC mi$3.30, ph$7.80 PB 144 801

The feasibility and applicability of a washdown or water curtain system against radioactive fallout for building roofs were evaluated, based on the results of a water requirements experiment plus presently available information. The system was found to be both feasible and applicable. The evaluation is based on commercially available components, including the test surfaces. However, some thoughts are also given on a new general design of buildings and on roofing surfaces to be developed to obtain optimum roof washdown effectiveness.

Ship Building

Battelle Memorial Inst., Columbus, Ohio.
EVALUATION OF WELD-JOINT FLAWS AS INITIATING POINTS OF BRITTLE FRACTURE, by R. P. Sopher, A. L. Lowe, Jr., and P. J. Rieppel. Rept. on Contract NObs-61748. 29 Aug 58, 56p. 5 refs. SSC-107.
Order from OTS $1.50 PB 161 323

A study of conditions needed for initiation of a brittle fracture from flaws 4 in. or less in length. If local stresses are high in the vicinity of a flaw, then the applied stress may be low when brittle fracture initiates from that flaw provided that the steel is at or near the nil ductility temperature. Stress conditions that are expected to exist in ship structures were incorporated in the test specimen.

David Taylor Model Basin, Washington, D. C.
POWERING CHARACTERISTICS FOR A LIBERTY SHIP PROPELLED BY OUTBOARD TYPE PROPULSION UNITS, MODEL 3748-1, by B. Nakonechny and A. H. Weaver, Jr. Jan 58, 22p. 3 refs. Rept. 1263.
Order from LC mi$2.70, ph$4.80 PB 144 644

The David Taylor Model Basin conducted experiments on a model of a Liberty ship to determine (1) the number of outboard-type marine propulsion units needed to propel the ship at speeds of 8 and 10 knots, (2) the best locations along the second deck for installing the units, and (3) the optimum axis of rotation of

the propeller. It was concluded from the tests that at least three units are required for a speed of 8 knots and five units for a speed of 10 knots; that there are seven satisfactory locations for installing the units; and that the optimum axis of rotation for the propeller is zero degree (parallel to centerline of ship) in all locations except one. It was also recommended that a suitable plate be fitted on the full-scale propulsion units. (Author)

Illinois U., Urbana.
PRELIMINARY STUDIES OF BRITTLE FRACTURE PROPAGATION IN STRUCTURAL STEEL, by W. J. Hall, W. G. Godden and O. A. Fettahlioglu. Rept. on Contracts NObs-(65790, 72046). 15 May 58, 91p. 17 refs. SSC-111.
Order from OTS $2.25 PB 161 325

Tests were conducted to obtain information concerning the crack speed and the strain distribution in a mild steel plate during brittle crack propagation. The adopted specimen consists of an insert plate welded to pull plates mounted in the testing machine. The plate is cooled with dry ice, and impact drives a wedge into a notch in the edge of the specimen. Crack speeds ranging from 1150 to 5900 fps were recorded; absolute peak elastic strains as high as 0.002500 in. per in. were recorded in the vicinity of the fracture with negligible permanent set remaining after the fracture.

Naval Ordnance Lab., White Oak, Md.
THE INVESTIGATION OF RADIOISOTOPES FOR THE INSPECTION OF SHIP WELDS, by E. L. Criscuolo, D. P. Case, and D. Polansky. 28 Feb 58, 64p. 12 refs. SSC-110.
Order from OTS $1.75 PB 161 324

A study was conducted that explored the potentialities of radioactive isotopes for the inspection of welds in ship structures. Various parameters were investigated to determine an optimum radiographic technique for the inspection of hull welds of 1/2- to 2-in. plate. Technique and sensitivity curves for thulium, iridium, cesium, and colbalt are included. For the inspection of welds in 1/2-in. to 1-in. thick plate, iridium is the most promising isotope. A portable exposure container for iridium has been developed.

Swarthmore Coll., Pa.
WELD FLAW EVALUATION, by Samuel T. Carpenter and Roy F. Linsenmeyer. Final rept. on Contract NObs-72060. 29 July 58, 122p. 14 refs. SSC-105.
Order from OTS $2.75 PB 161 322

This report is an evaluation of the ability of weld flaws to initiate brittle fracture. It deals with brittle fracture mechanics, static tests on flawed butt welds, static and dynamic tests on small butt weld flaws with and without residual stress, and static tests on weld flaws in a controlled field of high residual stress.

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Rodman Lab., Watertown Arsenal, Mass.
EVALUATION OF SEVERAL TOOL-LIFE TESTING TECHNIQUES, by Roy Mennell and Edwin A. Jeffery. Dec 58, 39p. 9 refs. Rept. no. RPL 23/5.
Order from LC mi$3.00, ph$6.30 PB 138 506

During testing, tool rake angles, cutting speed, and depth of cut were varied and other machining variables controlled or randomized. Accelerated tool-life criteria evaluated include: wear-land on the flank face of the cutting tool, percentage increase in feed force on the cutting tool, and surface finish of the workpiece.

Rutgers [State] U. [New Brunswick, N. J.]
PRELIMINARY STUDY ON JUMPING AND RUNNING TYPES OF LOCOMOTION, by R. K. Bernhard. July 58, 54p. 12 refs. Land Locomotion Research Branch rept. no. 43; AD-220 980.
Order from LC mi$3.60, ph$9.30 PB 144 540

Running, leaping, galloping, bouncing and jumping motions are analyzed from theoretical considerations for their applications to vehicle propulsion. The theory is then substantiated by test data taken from a laboratory analogue of various oscillatory motions. Cross-country speeds on the order of 20-30 mph are proved feasible compared to the 5-10 mph speeds obtainable by present wheeled and tracked vehicles. Since the oscillations may be uncomfortable to the vehicle operator, various isolation systems are proposed. (Author)

Engines and Propulsion Systems

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
TABLE OF LEGENDRE FUNCTIONS FOR COMPLEX ARGUMENTS, by M. E. Lyman. Rept. on Contract NOrd-7386. 10 Dec 58, 25p. 2 refs. TG-323; AD-209 360.
Order from LC mi$2.70, ph$4.80 PB 144 718

These calculations were made on the Univac Scientific 1103A Computer, using the subroutine written for the calculations of rocket instability. Since precision was not required, no attempt has been made to minimize loss of accuracy.

Arnold Engineering Development Center, Tullahoma, Tenn.
EVALUATION OF HOT-WATER-DRIVEN DIFFUSER EJECTORS, by R. P. Rhodes. Rept. on ARO, Inc., Contract AF 40(600)800. Nov 59, 32p. 3 refs. AEDC-TN-59-127; AD-227 981.
Order from LC mi$3.00, ph$6.30 PB 144 415

Exploratory investigations were conducted to evaluate the performance of various diffuser-ejector configurations driven by water heated to the saturation temperature. The apparatus consisted of a nozzle mounted axially in a cylindrical diffuser, which was connected to an exhaust system. A pressure vessel was provided in which the water was collected and heated. Tests were conducted using nozzle configurations having water flows ranging from 0.39 to 3.99 lb/sec at a driving pressure of 200 psia in combination with 6, 8, and 10-in. diffusers. At this fixed driving pressure, the mass flow of water per unit diffuser area was found to be the controlling parameter. As this parameter was increased, the maximum rise ratio of the ejector decreased, and the cell pressure increased. Lowering the driving pressure reduced the minimum cell pressure but also reduced the pressure rise ratio across the diffuser. A maximum ejector rise ratio of 4.2 and a minimum cell pressure of 0.22 psia were achieved during the course of this investigation.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE PREPARATION OF 3,3,3,-TRIS (NITRATOMETHYL)-PROPENE-1 AND 3,3-BIS (NITRATOMETHYL)-BUTENE-1, by Lester P. Kuhn and Alan C. Duckworth. Aug 59, 14p. 4 refs. Memo. rept. no. 1230.
Order from LC mi$2.40, ph$3.30 PB 144 729

The synthesis of two new vinyl compounds containing nitrate ester groups and having the structures

$CH_2 = CHC(CH_2ONO_2)_3$ and $CH_2 = CHC(CH_2ONO_2)_2CH_3$

is described. Many of the intermediates involved in the preparation of these compounds are also described for the first time in this report.

Detroit Arsenal, Center Line, Mich.
LOW TEMPERATURE TEST OF THE RELOCATED CRANKCASE OIL DIAPHRAGM BREATHER ASSEMBLY, by Milton C. DuBay. 25 Nov 57, 24p. Rept. no. 4025 (Final); AD-156 378.
Order from LC mi$2.70, ph$4.80 PB 144 760

The object of this test was to determine whether freezing of a relocated crankcase oil diaphragm breather assembly, as installed on the AVI 1790-8 engine, can be obtained at the low temperature of minus 40 F.

Diamond Ordnance Fuze Labs., Washington, D. C.
A TRANSISTORIZED TELEMETER FOR THE MEASUREMENT OF ROCKET-MOTOR PRESSURE ON THE APG STATIC SPIN STAND, by Walter L. Gieseler. 10 Apr 59, 12p. 1 ref. TR-728; AD-219 322.
Order from LC mi$2.40, ph$3.30 PB 144 664

A telemeter has been developed for determining rocket-motor pressures during tests on the static spin stand of the Ballistic Research Laboratories at Aberdeen Proving Ground. This device is designed to telemeter pressures up to about 2000 psi, and to withstand spin rates of about 200 rps. The circuit design and test results are given. (Author)

Propulsion Research Lab., Polytechnic Inst. of Brooklyn, N. Y.
A NON-LINEAR NON-STEADY AEROTHERMOCHEMICAL ANALYSIS OF COMBUSTION INSTABILITY IN A ROCKET CHAMBER, by Henry Berger. Rept. on Contract AF 49(638)165. 1 May 59, 83p. 16 refs. Technical note PRL-TN-59-5; AFOSR-TN-59-703.
Order from LC mi$4.80, ph$13.80 PB 144 500

In this report the fundamental equations are carefully derived. The assumptions necessary to obtain an approximate quasi-one-dimensional system of equations are explained. The characteristic equations are then derived; their final form is changed slightly in order to suit the numerical procedures. The steady state gas flow conditions constitute the initial conditions of the problem. Various steady state equations are derived and the stability of some of these in difference form is considered briefly. The special problems arising from the use of a zero initial velocity at the injector are analysed in detail. Use of an integrated form of the energy equation is made in avoiding some of these difficulties. Numerical results are obtained by using representative estimates for some of the parameters and are presented graphically. A rigorous method of numerical integration of the non-steady equations, differing from the standard characteristic method common in gas dynamics analyses, is examined. Its advantages are considered and sample numerical calculations are presented.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
SPRAY COMBUSTION THEORY, by F. A. Williams. Technical rept. no. 26 on Contract DA 04-495-ORD-446. Aug 58, 20p. 4 refs. AD-203 610.
Order from LC mi$2.40, ph$3.30 PB 137 529

The coupled steady-state equations of motion of a statistical ensemble of spherical droplets and a coexisting multicomponent reacting gaseous continuum are derived under the assumption that the induced random fluctuations in the properties of the fluid are negligible. These equations are reduced to a form appropriate for describing the one-dimensional flow of a fluid containing a spray which is stationary with respect to the gas. The burning-rate eigenvalue problem for one-dimensional heterogeneous combustion process of the type $A \rightarrow nB$ is formulated, and an analysis for sprays composed of uniform droplets illustrates the properties of the eigenvalue. An approximate analytical solution for the burning velocity is shown to be in numerical agreement with experiments on tetralin. (See also PB 136 043)

Sundstrand Turbo Div., Sundstrand Machine Tool Co. [Pacoima, Calif.]
SELECTED SCALING PROCUDURES FOR LIQUID-FUEL ROCKET ENGINES, by S. S. Penner. Technical note no. 6 on Contract AF 18(603)107. 31 Mar 58 17p. 5 refs. S/TD no. 1241; AFOSR-TN-58-416; AD-158 219.
Order from LC mi$2.40, ph$3.30 PB 144 656

In previous technical notes, we have considered the development of scaling procedures for liquid-fuel rocket engines with maintenance of complete simi-

larity for all important operating variables, and also the special case in which only similarity with respect to high-frequency oscillations is enforced. It is the purpose of the present discussion to consider scaling rules of intermediate scope. The judicious utilization of the results derived from the present study should prove of value in deciding on the particular set of similarity conditions which must be satisfied in order to minimize development costs for large-scale engines.

Machine Parts and Mechanisms

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
A BIBLIOGRAPHY ON GAS LUBRICATED BEARINGS - REVISED, by Eugene B. Sciulli. Rept. on Contract Nonr-2342(00). 15 Sep 59, 109p. 290 refs. Interim rept. I-A2049-5.
Order from OTS $2.50 PB 161 017

Wherever possible a resumé in English of each reference is included. In most cases the abstracts were taken verbatim from the author, translation being made when required. When necessary or desirable, resumés were prepared or revised by FIL staff members. Five indexes are provided: A Yearly index; Corporate Name index; Subject index containing thirteen descriptively worded categories or headings specifically chosen to cover the many varieties and types of gas lubricated bearings; an index listing all the patents in numerical order; and an index listing the country of origin of the reference when that country is other than the United States. Every effort has been made to make this a comprehensive listing of all references published prior to July 1, 1959.

Manufacturing Equipment and Processes

Battelle Memorial Inst., Columbus, Ohio.
RESEARCH AND DEVELOPMENT OF PROCEDURES FOR JOINING OF SIMILAR AND DISSIMILAR HEAT-RESISTING ALLOYS BY ULTRASONIC WELDING, by Norman E. Weare, John N. Antonevich and others. Rept. for July 57-June 58 on Metallic Materials, Contract AF 33(616)5342. Feb 59, 83p. 16 refs. WADC Technical rept. 58-479; AD-208 323.
Order from LC mi$4.80, ph$13.80 PB 145 015

Metallographic examinations of the heat-resistant weldments showed the presence of cracks at the edges of many of the spot welds. Methods of preventing such cracking can probably be determined. Efforts in the fundamental studies were aimed at studying the mechanism of bonding by ultrasonic welding.

Climax Molybdenum Co. of Michigan, Detroit.
ARC-CAST MOLYBDENUM-BASE ALLOYS, by M. Semchyshen and R. Q. Barr. Supplement to summary rept. on Contract N8onr-78701. 1957. 171p. 22 refs.
Order from LC mi$8.10, ph$27.30 PB 144 447

Contents:
Mechanical properties of wrought alloys
Mechanism of strengthening within the molybdenum-titanium system
Alloy systems:
Molybdenum-titanium
Molybdenum-niobium
Molybdenum-zirconium
Molybdenum-hafnium
Metallographic techniques
X-ray fluorescence analysis for alloying elements in molybdenum-base alloys

Columbia U. School of Engineering, New York.
A SIMPLE ALLOCATION PROBLEM, by C. Derman, Technical rept. no. 1(N) on Contract Nonr-266(55). 26 Jan 59, 14p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 144 554

We are concerned with the following allocation problem. Suppose at the beginning of a given time period there exists T units of some product (or service) which are to be allocated among k locations. The demand at each location is a random variable with a distribution which depends on the location. At the end of the time period the unused produce (or service) loses its value. The problem of interest here is that of allocating the T units among the k locations so that the expected number of units used to satisfy demand is maximized.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE WELDING OF WROUGHT AGE-HARDENABLE NICKEL-BASE ALLOYS FOR SERVICE AT ELEVATED TEMPERATURES, by W. J. Lepowski and R. E. Monroe. 25 Nov 59, 21p. 39 refs. DMIC memo. 38.
Order from OTS $0.50 PB 161 188

The purpose of this memorandum is to summarize information on welding wrought age-hardenable nickel-base alloys. The report will cover the fusion and resistance welding of some of the more familiar alloys that comprise the age-hardenable nickel-base materials.

Princeton U., N. J.
ESTIMATES OF NATIONAL AND REGIONAL STEEL PRODUCTION IN THE UNITED STATES FOR 1970,, by Robert E. Kuenne. Technical rept. no. 4 on Contract Nonr-1858(02). 2 Feb 59, 46p. 20 refs. Econometric Research Program Research Memo. no. 6.
Order from LC mi$3.30, ph$7.80 PB 144 577

MATERIALS

Department of the Army, Washington, D. C.
JOINT MILITARY-INDUSTRY PACKAGING AND

MATERIALS HANDLING SYMPOSIUM [NO. 3]
1-3 OCTOBER 1957, FORT LEE, VA. Oct 57, 177p.
Order from LC mi$8.10, ph$27.30 PB 144 930

A series of papers which includes, among others the following subjects: Packaging and handling for your FUTURARMY; Aerial delivery techniques and progress; Food packaging developments; Transportation developments; Current Army packaging practices and concepts; Project MASS; Packaging and materials handling equipment for guided missiles; Paper and paperboard containers; The steel shipping container; Flexible packaging barriers; Humidity indicators; Reinforced plastics for military packaging; New pallet designs and racks; Handling of specialized loads; Radio-controlled tractor trains; Personal communications in materials handling; The logair operation; Inter-theater airlift; Intra-theater airlift; Marine Corps developments; Tools for underway resupply; Review of recent changes to some of the major packaging and materials handling documents; Analysis of major changes--specification MIL-P-116C; "Preservation, methods of"

Detroit Arsenal, Center Line, Mich.
HANDBOOK OF THE FUNGI PRESCRIBED FOR USE IN MILITARY SPECIFICATIONS, by Charles B. Lee. 25 Mar 57, 136p. Rept. no. 3656 (Final).
Order from LC mi$6.90, ph$23.10 PB 144 678

This handbook is arranged with an introduction to and a definition of the classes, genera and species of fungi observed in the deterioration of military materials. Three classes of the lower fungi are discussed and species from these classes are illustrated either by photograph or drawing and each is given a brief description in non-technical language. A total of thirty-one species of fungi is mentioned and, in addition, taxonomic keys are presented as aids in identification. A short specification analysis by species is also included.

Naval Civil Engineering Lab., Port Hueneme, Calif.
A FEASIBILITY STUDY OF THE APPLICATION OF MASS SPECTROMETRY TO PAINT VEHICLE ANALYSIS, by R. D. Hitchcock. Interim rept. 11 Sep 59, 96p. 28 refs. Technical rept. 030; AD-209 528.
Order from OTS $2.25 PB 161 326

A Pyrex glass heated-inlet system was designed and built for the introduction of paint vehicles into the mass spectrometer in a vapor state. It was found that a conventional ball-and-socket glass joint, operable by external magnets, could be used as a vacuum cut-off valve. It was also found that stable temperatures could be maintained in the inlet system without hermostatic control. Repeated analyses of linseed oil at 250 C, 300 C, 350 C, and 400 C were made. Repeated analyses of a vinyl alkyd vehicle and a paint solvent were made and for each material the prominent peaks were treated mathematically to yield a single frequency distribution. Both distributions appeared to be almost perfectly Gaussian -- an indication that, because of the small number of peaks, the measured values of each peak are normally distributed. Percentage standard deviations derived from the plots showed that variations for the vinyl alkyd peaks are of the order of magnitude of 4 percent, and for the solvent, of the order of magnitude of 2 percent. The cracking patterns of other drying oils and synthetic resins and mixtures of these two types of vehicles were measured and studied. It is concluded that a Pyrex glass heated-inlet system can be used to introduce the vapors of paint vehicles into a mass spectrometer and that, in spite of random variations in molecular structure induced by elevated temperatures, a distinct cracking pattern can be associated with each vehicle. (Author)

Wayne [State] U., Detroit, Mich.
OPERATING CHARACTERISTIC CURVES AND OTHER FEATURES OF TRUNCATED LIFE TESTS WITH REPLACEMENT, by Benjamin Epstein. Technical rept. no. 5 on Contract Nonr-451(00). 15 May 53, 49p. 2 refs. AD 11 455.
Order from LC mi$3.30, ph$7.80 PB 145 034

The purpose of this report is to furnish some tables and graphs for the replacement case when items which fail are replaced at once by new items.

Ceramics and Refractories

Clevite Research Center, Cleveland, Ohio.
MODIFIED PIEZOELECTRIC LEAD TITANATE ZIRCONATE CERAMICS, by Frank Kulcsar. Technical rept. no. 14 on Contract Nonr-1055(00). 2 Dec 57, 29p. 1 ref. AD-150 443.
Order from LC mi$2.70, ph$4.80 PB 138 222

In an effort to increase the dielectric constant, small additions of Nb_2O_5 or Ta_2O_5 were made to lead titanate zirconate compositions near the morphotropic phase boundary. The compounds, PbO, TiO_2, ZrO_2, and one of the addition compounds (Nb_2O_5, Ta_2O_5, La_2O_3, and $SrCO_3$) were mixed and pressed into disks. Electrical measurements were made at room temperature including measurements of the capacity, dissipation factor, and resonant and antiresonant frequencies. The modified ceramics had piezoelectric planar coupling coefficients of at least 0.50 and dielectric constants of up to 1300. The mechanical Q factor was decreased to about 70. A marked improvement was noted in shelf-aging characteristics and in stability with respect to the temperature dependence of the resonant frequency. The Curie temperature was also lowered. The grain structure was refined, especially the ceramics containing 2 w-% additions of Nb_2O_5 or Ta_2O_5. Dielectric constants up to 1695 with planar couplings of about 0.55 were obtained by adding 1 w-% Nb or 2 w-% Ta to $Pb_{0.95}Sr_{0.05}(Zr_{0.54}Ti_{0.46})O_3$.

Fansteel Metallurgical Corp., North Chicago, Ill.
INFORMAL MONTHLY PROGRESS REPORT [TO NEPA PROJECT] by Ralph Wehrmann. Rept. for 21 July-20 Aug 48. 26 Aug 48, 8p. NEPA 738-FAN-14; AD-203 997.
Order from LC mi$1.80, ph$1.80 PB 138 315

Fansteel Metallurgical Corp., North Chicago, Ill.
INFORMAL MONTHLY PROGRESS REPORT TO NEPA PROJECT, by Ralph Wehrmann. Rept. for 21 Nov - 20 Dec 48. 24 Dec 48, 7p. NEPA 858-FAN-19; AD-203 995.
Order from LC mi$1.80, ph$1.80 PB 138 322

See also PB 138 315.

Massachusetts Inst. of Tech., Cambridge.
TITANIUM CARBIDE-NICKEL CERMETS: PROCESSING AND JOINING, by John Wulff, James E. Cline and others. Rept. on Contract AF 33(038)8879. Mar 52, declassified 15 Dec 53. 21p. 17 refs. WADC Technical rept. 52-103; ATI-171 301.
Order from LC mi$2.70, ph$4.80 PB 144 559

Titanium carbide-nickel cermets can be sintered to have transverse rupture strengths over 250,000 pounds per square inch. Joining titanium-carbide cermets to high-temperature alloys has been accomplished by vacuum diffusion, and gives a weld stronger than the cermet. Fabrication of cermet articles of graded composition has been successfully accomplished by fragmentation-forming, i.e. cold forging the powder in a ductile envelope and subsequently sintering.

Pennsylvania State [U. Mineral Industries Experiment Station, University Park]
AN EXPERIMENTAL STUDY OF SILICATE LIQUID IMMISCIBILITY, by M. D. Karkhanavala and W. A. Weyl. ONR Technical rept. no. 45 on Contract N6onr-269, Task Order 8. Apr 52, 6p. 6 refs. ATI-159 366.
Order from LC mi$1.80, ph$1.80 PB 144 560

The inverted S-shaped liquidus curve of certain silicate systems (Li_2O-SiO_2 and BaO-SiO_2) is attributed to an existing "tendency" towards immiscibility. The authors advance a theory of the atomic structure of a homogeneous phase having a tendency towards unmixing. It is assumed that two basically different types of groups are present, but that the interfacial energy is too high to allow these groups to form separate phases. This difficulty can be overcome by bringing into the system a noble metal (Pd) in a finely subdivided state. By this means a homogeneous melt of 10.4 mol % Li_2O and 89.6 mol % SiO_2 was separated into two phases.

Fuels, Lubricants, and Hydraulic Fluids

Aerojet-General Corp., Azusa, Calif.
PRESSURE-MEASURING INSTRUMENTATION FOR COMBUSTION STABILITY STUDIES, by Leon Green, Jr. Rept. on Contract AF 18(600)1048. Dec 55, 43p. AGC TN-14; OSR-TN-55-474; AD-81 081.
Order from LC mi$3.30, ph$7.80 PB 137 840

The operation of the pressure-measuring system employed in the solid-propellant combustion stability study being pursued under the present contract is described, and the limitations of the system are pointed out.

Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF THE INFLUENCE OF LUBRICANT PROPERTIES ON THE PERFORMANCE OF AIRCRAFT GAS TURBINE ENGINE ROLLING-CONTACT BEARINGS, by L. B. Sibley, J. C. Bell and others. Final technical rept. for 22 Apr 57-21 Sep 58 on Contract AF 33(616)5109. Oct 58, 75p. 73 refs. WADC Technical rept. 58-565; AD-204 218.
Order from LC mi$4.50, ph$12.30 PB 145 032

The development of improved lubricants for aircraft gas turbine engine bearings depends, to a large extent, on how well the influence of lubricant properties on bearing performance can be predicted. A literature and field survey and some special experiments and analyses on this problem have been conducted. A possible approach for further research in this field is suggested.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF QUANTITATIVE TESTS FOR ESTABLISHMENT OF STABILITY OF PROPELLANT, by Charles Lenchitz, Norman E. Beach, and Marvin Goldstein. Dec 58, 9p. 2 refs. Technical memo. no. GL-5-58.
Order from LC mi$1.80, ph$1.80 PB 138 354

As basic information, the stability tests standard at this Arsenal were evaluated for quantitative efficiency. This work substantiates a belief that the current thermal stability tests are qualitative rather than quantitative. The present tests are based on the detection or measurement of the gaseous products of propellant decomposition.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
INVESTIGATION OF THE STABILITY OF DETERIORATING PROPELLANTS, by Norman E. Beach. Dec 58, 21p. 1 ref. Technical memo. no. GL-4-58.
Order from LC mi$2.70, ph$4.80 PB 138 355

This report covers the accomplishments under the initial project. The scope of this "starter" project was to plan for and initiate work leading to the determination of the safe-life characteristics of propellants, and the test(s) or determination (s) which best give basis for a prediction of remaining safe life of propellants.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
NATIONAL EVALUATION OF THE QUICK TEST FOR DETECTION OF PROPELLANT DETERIORATION, by Norman E. Beach and John F. Dippman. Dec 58, 48p. Technical memo. no. GL-1-58.
Order from LC mi$3.30, ph$7.80 PB 138 356

Object was to effect a wide, unbiased trial of the Quick Test for detection of deterioration in stored propellant through the independent efforts of the potential user. The parameters for evaluation are: functional adaptability, universality, relation to existing stability tests and efficiency with respect to the establishment of cut-off criteria.

Naval Research Lab., Washington, D. C.
FLUOROALKOXYSILANES, by C. M. Murphy, J. G. O'Rear and others. Interim rept. 15 Dec 59, 16p. 9 refs. NRL rept. 5411.
Order from OTS $0.50 PB 161 026

Eight fluoroalkyl esters of silicic acid and one of phosphoric acid were prepared from the fluoroalcohols $F(CF_2)_n CH_2OH$, $H(CF_2CF_2)_nCH_2OH$, $H(CF_2CF_2)_n(CHOH(CH_3)$, and $H(CF_2CF_2)_nCOH(CH_3)_2$. These orthoesters were studied as potential high-temperature lubricants and hydraulic fluids. Most of the compounds have pour points below -65°F. Increasing the fluorine content improves flammability resistance but raises the viscosity-temperature coefficient. Orthoesters derived from primary fluoroalcohols are resistant to pyrolysis and oxidation but sensitive to hydrolysis. Stabilization against hydrolysis is achieved by introducing one or two tert-butoxy groups but at the expense of thermal and oxidation stability. Both secondary and tertiary fluoroalkoxy groups are inferior to tert-butoxy groups for stabilizing orthoesters against hydrolysis. The best compromise structures fail one or more of the requirements for a satisfactory high-temperature lubricant or hydraulic fluid.

Leather and Textiles

Fabric Research Labs., Inc., Dedham, Mass.
AN INDEX OF BLEND IRREGULARITY AND ITS PRACTICAL USE, by Myron J. Coplan, Charles A. Lermond, and Ruth A. Kenney. Technical rept. no. 4 on Contract Nonr-1422(00). 31 Dec 57, 26p. 12 refs.
Order from LC mi$2.70, ph$4.80 PB 138 405

It appears that staple processing machining tends to allow fibers to remain in clusters. Three cylinder carding reduces this somewhat. Drafting apparently reduced the clustering as evidenced by blend distribution along the strand length. The actions of doubling and condensing alone cannot accomplish this, but seem to randomize single fibers within cross-sections. (See also PB 124 313)

Fuels Research Lab., Mass. Inst. of Tech., Cambridge.
HEAT TRANSFER TO SKIN THROUGH THERMALLY-IRRADIATED DRY CLOTH, by N. Y. Chen and W. P. Jensen. Technical rept. no. 6 on Contract Nonr-1841(37). 8 July 58, 71p. 7 refs. AD-200 210.
Order from LC mi$4.50, ph$12.30 PB 144 818

An analysis is presented of the problem of heat transmission through dry opaque or diathermanous cloth and an air space into underlying skin, following exposure to thermal radiation. The problem is solved numerically by finite difference approximations, the method being given in detail. It is shown that a technique requiring only the appropriate weighting of temperature-rise data obtained from three curves yields results within 1 to 2% of those obtained by extensive machine calculations in which allowance is made for energy absorption at each of several increments into which the diathermanous cloth is conceptually divided. The analytical work is verified by good agreement with experimental results.

Owens-Corning Fiberglas Corp., Newark, Ohio.
PROPERTIES OF GLASS FIBERS AT ELEVATED TEMPERATURES, by W. H. Otto. Final rept. for 15 June 58-15 Aug 59 on Contract NOas-58-841-c. 15 Sep 59, 80p. 4 refs.
Order from LC mi$4.50, ph$12.30 PB 144 574

Glass fibers of four different glass compositions were evaluated on the basis of measured tensile strength, stress-rupture and modulus of elasticity at elevated temperatures. Strength-temperature relations were established for each glass from 75°F to that temperature at which a reduction of approximately seventy-five per cent of the original value was encountered. Stress-rupture measurements over the possible temperature range were made for load durations up to twenty hours. Measurements of modulus of elasticity were made at temperatures up to the softening temperature of the fibers. The effects of environment and commercial organic finishes on tensile strength and stress-rupture were investigated. (Author) (See also PB 143 669)

Quartermaster Research and Engineering Center, Natick, Mass.
STUDIES ON THERMAL PROPERTIES OF FABRICS OF VARYING SPECTRAL RESPONSE FOR THE OUTER LAYER OF THE COLD-WET UNIFORM IN A TWO-LAYER SYSTEM. PART I. PHYSICAL MEASUREMENTS OF FABRIC ASSEMBLIES. PART II. THERMAL PROTECTIVE PROPERTIES OF CAMOUFLAGE FABRICS, by Alvin O. Ramsley. Sep 59, 39p. 22 refs. Textile Series rept. 109; AD-227 159.
Order from LC mi$3.00, ph$6.30 PB 144 532

An investigation considering the problem of whether the somewhat higher absorptance required for adequate infrared camouflage would increase hazards from thermal radiation is described. Three cotton fabrics were used which differed from each other only in regard to the specific vat dyes required to achieve OD-7 and OG-107. One sample was vat dyed to a visual shade matching OG-107 but having a reflectance at 1μ satisfactory for good camouflage against active infrared detectors. Part I describes preparation of samples, optical and thermal measurements. Thermal data were obtained with the Quartermaster carbon arc source and inanimate receivers. Part II reviews available literature which used similar fabric systems. Previously reported data, obtained both in laboratory and field studies, neither refute nor corroborate the view that a good infrared camouflage colorant system in clothing assemblies is necessarily inimical to good thermal protection. The experi-

mental portion describes a test in which pigs were protected during exposure to the carbon arc source by each of the 3 fabrics. It was concluded that the fabric which possesses all the reflectance characteristics necessary for good camouflage affords at least as good protection as the present standard OG-107. (Author)

Plastics

Aerojet-General Corp., Azusa, Calif.
A STUDY OF THE KINETICS OF SOLID-PHASE REACTIONS. Quarterly no. 9, 16 Sep-15 Dec 58, on Contract AF 18(603)74. 12 Dec 58, 9p. 3 refs. Rept. no. 1282-9.
Order from LC mi$1.80, ph$1.80 PB 144 571

The surface decomposition (linear pyrolysis) of both linear and cross-linked polymethylmethacrylate polymers has been studied over the surface-temperature range from 550 to 910°K.

Army Prosthetics Research Lab., Washington, D. C
REVISED TECHNIQUE FOR STAINING VINYL FILMS, by James T. Hill. 13 Oct 58, 5p. 1 ref. Technical rept. no. 5838; AD-205 260.
Order from LC mi$1.80, ph$1.80 PB 144 726

A revised technique of staining vinyl films, to determine their resistance to oil soluble inks, is presented A new ink formula is also presented to insure a reproducible supply of stainant. (Author)

Cornell U., Ithaca, N. Y.
AN EXPERIMENTAL STUDY OF MECHANICAL AND DIELECTRIC LOSSES IN CERTAIN HIGH POLYMERS, by H. S. Sack. Final rept. on Contract Nonr-401(09). Jan 59, 90p. 23 refs.
Order from LC mi$4.80, ph$13.80 PB 144 405

Second-order transitions in pure polyvinyl acetate, cellulose acetate pure and plasticized, cellulose nitrate pure, plasticized, plasticized and stabilized, and plasticized and cross-linked were studied using both mechanical and dielectric loss measurements. In the study of mechanical losses, the main effort was directed towards low frequencies, and equipment was designed which permitted measurements down to about 10^{-4} cps. Temperatures as low as -200°C were used in some cases. Dielectric measurements were made at higher frequencies, i.e., 60 cps to 2 mc. The addition of a plasticizer does not change radically the value of the activation energy for any particular transition, but only shifts the peaks to lower temperatures. The addition of a stabilizer makes the measurements more consistent and reproducible. Contrary to expectation, cross-linking reduces the value of the activation energy as observed from dielectric measurements. Plasticized samples are found to be rather unstable. It is suspected that the plasticizer evaporates during the experiments, thus often leading to incorrect results.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
PREPARATION AND CHARACTERIZATION OF GRAFT COPOLYMERS, by Suresh N. Chinai, Jacob D. Matlack and others. Nov 59, 28p. 20 refs. Technical rept. 2660.
Order from OTS $0.75 PB 161 047

A number of synthetic problems involved in the preparation of poly(methyl methacrylate) grafted to polystyrene and its precursors have been resolved. The preparation of a completely isopropylated polystyrene by the polymerization of p-isopropylstyrene monomer has obviated earlier difficulties of color, fluorescence, and variable composition. The subsequent antoxidation of this material in a non-aromatic solvent, cyclohexane, with lauroyl peroxide as the oxidation catalyst has yielded a material of good reproducibility and high purity. Resorting to a sugar-containing polymerization recipe gave grafting at favorable rates with fair reproducibility. The grafts and their precursors were characterized by light-scattering and viscosity techniques. The apparently insufficiently dissimilar nature of the component polymers prevented the resolution of the polymeric mixture by extraction and fractional precipitation methods into similar structural species. The course of the fractional precipitation was followed with radioactive polymer. The infrared spectra of the p-isopropylstyrene monomer and its intermediates, and of related polymeric materials, are presented and analyzed in this report.

Material Lab., New York Naval Shipyard, Brooklyn.
THE EFFECTS OF WATER IMMERSION ON THE PROPERTIES OF GLASS REINFORCED POLYESTER LAMINATES, by S. Dastin. Final rept. 5 Apr 57, 7p. Lab. Project 4860-J-5.
Order from LC mi$1.80, ph$1.80 PB 145 028

The effects of water immersion on the properties of woven roving reinforced polyester laminates have been studied. Laminates were fabricated at the Laboratory by the "void free" vacuum bag technique, employing present day improved finish woven roving reinforcements. The laminates investigated showed superior wet strength retention as compared to laminates fabricated with earlier woven roving reinforcements. Further, the study indicated that, with a general purpose polyester a one hour gel system is sufficient to wet the reinforcement satisfactorily and to yield a sound laminate. The investigation also showed that, if resistance to water attack is a prime consideration, the laminate should contain resin in excess of about 45% by weight. (Author)

Office of Technical Services, Washington, D. C.
NEW PLASTIC MATERIALS THROUGH GOVERNMENT RESEARCH, by James Kanegis. Aug 58, 95p. 143 refs.
Order from OTS $2.25 PB 161 332

Hundreds of unclassified R&D reports released over the past three years by government agencies have been analyzed for significant content. Those of greater interest have been selected for review in the following order: irradiated plastics; molding; transparent materials; adhesives; coatings; fibers; sealants,

foams, interlayers, honeycomb; laminates; specific plastics such as inorganic and metallorganic polymers, silicones, fluoroplastics, acrylics; polyesters, epoxides, polyurethanes; polyethylene; vinyls and vinylidenes; phenolics; others such as styrenes, polyamides, and S-base. Fields of interest of various agencies are outlined. Most comments are documented, usually by reference to specific PB reports. (Author)

Rubber and Elastomers

Rock Island Aresenal Lab., Ill.
IDENTIFICATION OF ELASTOMERS BY INFRARED SPECTRA OF THEIR PYROLYZATES, by J. W. McGarvey. 19 Aug 58, 24p. 7 refs. Rept. no. 58-2159.
Order from LC mi$2.70, ph$4.80 PB 138 408

Representative infrared spectra of the pyrolyzates of various types of elastomers were recorded for the purpose of identifying unknown elastomers by comparison. This procedure offers an unusually rapid, qualitative method of analysis and possesses certain advantages which are lacking in more conventional techniques. The identification of an unknown sample by comparison of its infrared pyrolyzate spectrum to reference spectra in this report will usually permit a complete analysis to be made in approximately twenty minutes.

Rock Island Arsenal Lab., Ill.
TENSILE TEST REPRODUCIBILITY OF ELASTOMERIC VULCANIZATES, by Stanley L. Eisler. 3 Sep 58, 29p. 9 refs. Rept. no. 58-2315.
Order from LC mi$2.70, ph$4.80 PB 138 409

A number of variables were studied to determine their effect on the reproducibility of tensile tests of elastomeric vulcanizates. It was found that the size of the filler particles and the presence of undispersed curative particles, which probably produced areas of overcure, were the two most important factors affecting the tensile test reproducibility. These findings are in contrast to most published work which has dealt principally with the sample preparation and test procedure errors.

Wood and Paper

Material Labs., Puget Sound Naval Shipyard, Bremerton, Wash.
MARINE LAMINATING PROPERTIES OF SELECTED WOOD SPECIES, KHAYA OR AFRICAN MAHOGANY (KHAYA SPP.) by R. F. England. Sep 59, 5p. 7 refs. Progress rept. no. E-412-4.
Order from LC mi$1.80, ph$1.80 PB 144 701

The laminating properties of Khaya were investigated using three commercial adhesives. Curing conditions of 150-153°F for 6 hours (glueline temperature) produced satisfactory results with each of the adhesives tested. (Author)

Material Labs., Puget Sound Naval Shipyard, Bremerton, Wash.
MARINE LAMINATING PROPERTIES OF SELECTED WOOD SPECIES, KOKRODUA (AFRORMOSIA ELATA) by R. F. England. Sep 59, 5p. 7 refs. Progress rept. no. E-412-5.
Order from LC mi$1.80, ph$1.80 PB 144 700

The laminating properties of Kokrodua (a tropical African hardwood) were investigated using three commerical adhesives. Curing conditions of 150-153°F for 6-1/2 hours (glueline temperature) produced satisfactory results with each of the adhesives tested. (Author)

Material Labs., Puget Sound Naval Shipyard, Bremerton, Wash.
MARINE LAMINATING PROPERTIES OF SELECTED WOOD SPECIES, GREENHEART (OCOTEA RODIAEI) by R. F. England. Sep 59, 6p. 7 refs. Progress rept. no. E-412-6.
Order from LC mi$1.80, ph$1.80 PB 144 699

The laminating properties of greenheart (a tropical South American hardwood) were investigated using three commercial adhesives. Curing conditions of 150-154°F for 6 hours (glueline temperature) produced unsatisfactory results with each of the adhesives tested. (Author)

MATHEMATICS

Air Force Cambridge Research Center, Bedford, Mass.
AN ALGORISM FOR FACTORING X^n-1 OVER A FINITE FIELD, by Eugene Prange. Oct 59, 23p. AFCRC-TN-59-775.
Order from LC mi$2.70, ph$4.80 PB 144 588

An algorism is given for factoring X^n-1 over the finite field F_q of q elements. This can be of use in constructing another finite field over F_q, in constructing a linear recursion of period n over F_q, or in constructing cyclic error-correcting group codes. The algorism has two parts: Step 1, the construction of the multiplicative identities of the minimal ideals of $F_q[X]/[X^n-1]$; Step 2, the use of these idempotents in the construction of the irreducible factors of X^n-1. (Author)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
A CONTINUOUS TRANSLATION OF HOLDER AND LIPSCHITZ FUNCTIONS, by H. Mirkil. Technical note no. 7 on Contract AF 49(638)294. 30 Oct 59, 19p. 6 refs. AFOSR-TN-59-983.
Order from LC mi$2.40, ph$3.30 PB 144 763

Applied Mathematics and Statistics Lab., Stanford U., Calif.
HOLDER CONTINUITY OF N-DIMENSIONAL QUASI-CONFORMAL MAPPINGS, by E. David Callender. Technical rept. no. 81 on Contract Nonr-225(11). 19 Feb 59, 32p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 144 813

This paper is an extension of previous work on the Hölder continuity of two-dimensional quasi-conformal mappings. The approach of Finn and Serrin is used to prove analogous results in n dimensions.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE ESTIMATION OF DISPERSION FROM DIFFERENCES, by Anthony P. Morse. 13 July 45, 21p. 6 refs. Rept. no. 557.
Order from LC mi$2.70, ph$4.80 PB 145 060

In order to estimate dispersions in data, it is frequently desirable to eliminate the effects of unknown trends. It is shown that this may often be done by employing differences of an appropriate order. Tables estimating the precision of such a method are given. (Author)

California U., Berkeley.
THE ASYMPTOTIC BEHAVIOUR OF THE REAL SOLUTIONS OF CERTAIN SECOND ORDER DIFFERENTIAL EQUATIONS, by J. G. van der Corput. Technical rept. no. 3 on Asymptotic Expansions, Contract AF 18(600)958. June 55, 175p. 7 refs. AD-74 696.
Order from LC mi$8.10, ph$27.30 PB 144 546

Primary consideration is given to complete asymptotic expansions of the form $y'' + [P(x) + f(x)]y' + [Q(x) + g(x)]y = 0$, where $f(x)$ and $g(x)$ are perturbations of the related equation $y'' + P(x)y' + Q(x)y = 0$. Attention is also given to the case where the full asymptotic expansion is not required, and weaker conditions on $f(x)$ and $g(x)$ are considered which permit a discussion of the behavior of the solutions at infinity. (See also PB 144 547)

California U., Berkeley.
FUNDAMENTAL THEOREMS OF ASYMPTOTICS, by J. G. van der Corput. Technical rept. no. 1 on Asymptotic Expansions, Contract AF 18(600)958. June 54, 71p. 2 refs. AD-39 511.
Order from LC mi$4.50, ph$12.30 PB 144 547

Topics covered are equality, limits, convergent series, convergent multiple series, uniform convergence, analytic functions with prescribed asymptotic expansion, and equations.

California U., Berkeley.
INFINITELY MULTIPLE VALUED HARMONIC FUNCTIONS IN SPACE WITH TWO BASE BRANCH CURVES OF ORDER ONE. PART II, by Griffith C. Evans. Technical rept. no. 4 on Contract Nonr-222(62). Jan 59, 21p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 144 552

See also PB 143 409

Chicago U., Ill.
STRONG INVERTIBILITY OF C^∞ FUNCTIONS, by John J. McKibben. Technical rept. no. 5 on Investigations in the Theory of Partial Differential Equations, Contract DA 11-022-ORD-1833. Aug 58, 14p.
Order from LC mi$2.40, ph$3.30 PB 138 576

This is a discussion of the strong invertibility of infinitely differentiable functions. It is proved that an infinitely differentiable function is strongly invertible at each of its non-singular zeros.

Chicago U., Ill.
THE TEN TYPES OF H-SPACES, by I. M. James. Rept. on Contract AF 18(600)1383. Aug 59, 11p. 17 refs. AFOSR-TN-59-857; AD-228 377.
Order from LC mi$2.40, ph$3.30 PB 144 495

Columbia U., New York.
A STATISTICAL SCREENING PROBLEM, by Herbert Robbins. Rept. on Contract Nonr-266(59). Feb 59, 11p. CU-1-59-Nonr-266(59)MS; AD-211 292.
Order from LC mi$2.40, ph$3.30 PB 144 825

The following decision problem is considered. Θ is an unknown quantity which when measured yields a random variable

$$X = \Theta + Y,$$

where Y, the error in measurement, is a random variable with known distribution function $G(y) = \Pr[Y \leq y]$.

Harvard U., Cambridge, Mass.
APPROXIMATION BY BOUNDED ANALYTIC FUNCTIONS: GENERAL CONFIGURATIONS, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Aug 58, 10p. 1 ref. AFOSR-TN-58-703; AD-162 237.
Order from LC mi$1.80, ph$1.80 PB 137 872

Harvard U. [Cambridge, Mass].
EXPANSIONS IN SERIES OF HOMOGENEOUS POLYNOMIAL SOLUTIONS OF THE GENERAL TWO-DIMENSIONAL LINEAR PARTIAL DIFFERENTIAL EQUATION OF THE SECOND ORDER WITH CONSTANT COEFFICIENTS, by D. V. Widder. Sep 58, 8p. 2 refs. AFOSR-TN-58-706; AD-162 240.
Order from LC mi$1.80, ph$1.80 PB 137 863

Harvard U. [Cambridge, Mass].
EXPANSIONS IN SERIES OF HOMOGENEOUS POLYNOMIAL SOLUTIONS OF THE TWO-DIMENSIONAL WAVE EQUATION, by D. V. Widder. Rept. on Contract AF 18(600)1461. Sep 58, 14p. 2 refs. AFOSR-TN-58-707; AD-162 241.
Order from LC mi$2.40, ph$3.30 PB 137 864

Harvard U., Cambridge, Mass.
NOTE ON APPROXIMATION BY BOUNDED ANALYTIC FUNCTIONS (PROBLEM α), by J. L. Walsh. Rept. on Contract AF 18(600)1461. Aug 58, 12p. 9 refs. AFOSR-TN-58-701; AD-162 235.
Order from LC mi$2.40, ph$3.30 PB 137 873

Harvard U., Cambridge, Mass.
NOTE ON INVARIANCE OF DEGREE OF POLYNOMIAL AND TRIGONOMETRIC APPROXIMATION UNDER CHANGE OF INDEPENDENT VARIABLE, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Aug 59, 14p. 6 refs. AFOSR-TN-59-593; AD-217 183.
Order from LC mi$2.40, ph$3.30 PB 144 489

The object of this note is to show that various commonly used measures of degree of approximation are invariant under one-to-one analytic transformation of the independent variable, and this is true for both approximation by polynomials in the complex variable and trigonometric approximation in the real variable. The methods used here have already been used several times in the literature, especially by J. H. Curtiss, and Walsh and Sewell, and Walsh, but the present treatment is more unified and more complete, and emphasizes for the first time invariance of degrees of approximation. (Author)

Harvard U., Cambridge, Mass.
NOTE ON LEAST-SQUARE APPROXIMATION TO AN ANALYTIC FUNCTION BY POLYNOMINALS, AS MEASURED BY A SURFACE INTEGRAL, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Aug 58, 13p. 2 refs. AFOSR-TN-58-708; AD-162 242.
Order from LC mi$2.40, ph$3.30 PB 137 926

Harvard U., Cambridge, Mass.
ON DEGREE OF APPROXIMATION BY BOUNDED HARMONIC FUNCTIONS, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Apr 59, 30p. 10 refs. AFOSR-TN-59-235; AD-212 005.
Order from LC mi$2.70, ph$4.80 PB 144 468

If $u(x, y)$ is defined on an analytic Jordan curve C, a necessary and sufficient condition that $u(x, y)$ be of class $L(p, \alpha)$, $0 < \alpha < 1$, on C is that there exist functions $u_n(x, y)$ harmonic in a region D containing C satisfying $|u_n(x,y)| = AR^n$ in D and $|u(x, y)-u_n(x, y)| \leq A_1/n^{p+\alpha}$ on C. This result on Problem α for harmonic functions can be complemented by a result on Problem β precisely analogous to Theorem 1 of TAMS vol. 87 (1958) pp. 467-484 provided $f(z)$ and $f_n(z)$ are supposed analytic on and within each B_j.

Harvard U., Cambridge, Mass.
POLYNOMIALS OF BEST APPROXIMATION ON AN INTERVAL, by J. L. Walsh and T. S. Motzkin (U. of California) Rept. on Contract AF 18(600)1461. Oct 59, 12p. 4 refs. AFOSR-TN-59-854; AD-228 078
Order from LC mi$2.40, ph$3.30 PB 144 494

The present writers have recently studied juxtapolynomials and their relation to polynomials of best approximation to a given function on a real finite point set, especially with reference to oscillation properties. The object of the present note is to indicate, partly without proof, new results on the analogous problems of approximation to a given continuous function on a closed finite interval E. (Author)

Institute for Advanced Study, Princeton, N. J.
ON A PROBLEM OF L. FEJES-TOTH, by B. Graunbaum. Rept. on Contract AF 49(638)253. Sep 59, 4p. AFOSR-TN-59-981; AD-228 282.
Order from LC mi$1.80, ph$1.80 PB 144 471

In Euclidean 3-space, a point is "hidden" by a set of spheres (which do not contain the point) if any ray issuing from the point intersects at least one of the spheres. Fejes-Toth established that six congruent, non-intersecting spheres may hide a point. We prove that five congruent non-intersection spheres may not hide a point.

Institute of Mathematical Sciences, New York U., N. Y.
THE INFLUENCE OF EDGES AND CORNERS ON POTENTIAL FUNCTIONS OF SURFACE LAYERS, by Rolf Leis. Rept. on Contract AF 49(638)229. June 59, 23p. 3 refs. Research rept. no. BR-29; AFOSR-TN-59-943.
Order from LC mi$2.70, ph$4.80 PB 144 766

The potential functions of multiple surface layers behave singularly when approaching the boundary of the surface. The degree of the singularities of these functions and their derivatives are discussed in this paper. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
ON SOME FREDHOLM INTEGRAL EQUATIONS ARISING IN DIFFRACTION THEORY, by C. H. Yang. Rept. on Contract AF 49(638)229. Aug 59, 20p. 7 refs. Research rept. BR-31; AFOSR-TN-59-944.
Order from LC mi$2.40, ph$3.30 PB 144 765

Kernels of integral equations arising in diffraction theory are investigated. These kernels depend on a parameter α. Fredholm's theory shows that the resolvents of the kernels are meromorphic functions of α and, hence, can be expanded into power series of α which are convergent for certain regions. Regions of convergence for α, in which the perturbation method would work, are examined. (Author)

Massachusetts Inst. of Tech., Cambridge.
LORENTZ STRUCTURES ON THE PLANE, by J. Wolfgang Smith. Technical note on Contract AF 49(638)42. [1959] 27p. 3 refs. AFOSR-TN-59-652.
Order from LC mi$2.70, ph$4.80 PB 144 659

Very little is known at present about the global properties of Lorentz manifolds. While these differ from Riemannian spaces ostensibly in the signature of the metric tensor field, one comes to realize quickly that Lorentz geometry in the large will require its own methods and must lead to some unaccustomed results.

Michigan U. [Ann Arbor].
RADIAL CLUSTER SETS AND THE DISTRIBUTION OF VALUES OF MEROMORPHIC FUNCTIONS, by W. B. Woolf. Rept. on Contract AF 49(638)104. Oct 59, 34p. 19 refs. AFOSR-TN-59-1041.
Order from LC mi$3.00, ph$6.30 PB 144 772

This paper is devoted to an investigation of the behavior near a singularity of a function $w = f(z)$ meromorphic in the unit disk. Particular emphasis is placed on the problem of deriving meaningful results for non-isolated singularities.

Minnesota U. [Minneapolis].
CHANGE OF TIME SCALE FOR MARKOV PROCESSES, by Steven Orey. Rept. on Contract AF 49(638)617. 1 Sep 59, 22p. 5 refs. AFOSR-TN-59-1067.
Order from LC mi$2.70, ph$4.80 PB 144 771

Let $\{X_n\}$ be a recurrent Markov chain, $n = 0, 1, \ldots$. A new process $\{X_t\}$, $0 \leq t < \infty$ is obtained from the original process by reguiring a wait of duration $\gamma(x)$ after reaching x, for every state x, where $\gamma(x) > 0$. Let $\tilde{X}_t = (X_t, Y_t)$, where Y_t is the elapsed time since the last transition. $\{\tilde{X}_t\}$ is a Markov process; Y_t is a generalized renewal process. Results are obtained about the structure of the $\tilde{X}_t$ - process and the asymptotic behavior of the transition probabilities. The case in which the waiting times are random variables is also treated. (Author)

Missouri U., Columbia.
SOME ASPECTS OF UNSTABLE HOMEOMORPHISMS, by J. F. Jakobsen and W. R. Utz. Technical rept. no. 10 on Contract AF 18(600)1108. Nov 58, 20p. 7 refs. AFOSR-TN-58-1040; AD-206 574.
Order from LC mi$2.40, ph$3.30 PB 138 353

Naval Research Lab., U. of Wisconsin, Madison.
THE EXPANSION AND INTEGRATION OF PRODUCTS OF SURFACE HARMONICS AND OF CERTAIN RELATED QUANTITIES, by M. P. Barnett. Rept. on Contract N7onr-28511. 25 Mar 58, 64p. 16 refs. WIS-ONR-30.
Order from LC mi$3.90, ph$10.80 PB 139 255

Formulae and tables are provided for the expansion of products of trigonometric functions and spherical harmonics as series in spherical harmonics, and for some integrals closely related to these expansion coefficients.

Naval Research Lab., U. of Wisconsin, Madison.
THE POWER SERIES EXPANSION OF A CERTAIN CLASS OF FUNCTIONALS, by M. P. Barnett. Rept. on Contract N7onr-28511. 7 Jan 59, 11p. 3 refs. WIS-ONR-35.
Order from LC mi$2.40, ph$3.30 PB 144 550

The technique described in this report is in effect a generalization of a procedure used in classical astronomy that involved the so-called Newcomb operators. The general procedure is derived in section 2, and is summarized in equations (11), (12), (15), (17), and (18). Section 3 deals with possible extensions of the method and, section 4 contains some comments on the relationship between the present method and the special cases treated previously by earlier workers.

P[erkin]-E[lmer] C[orp., Norwalk, Conn.]
SINGULAR DIFFERENTIAL BOUNDARY PROBLEMS OF A FOURIER TYPE, by Robert W. McKelvey. Rept. on Contract AF 33(616)5649. 30 Apr 59, 40p. 8 refs. WADC Technical rept. 59-288.
Order from OTS $1.00 PB 161 350

Let L be a linear differential operator defined for twice differentiable functions x(t) by $Lx = -x'' + q(t)x$, with q(t) real, continuous, and satisfying $\int_0^\infty t\,|q(t)|\,dt < \infty$. Since the operator L falls under Weyl's "limit point case", it follows that the differential equation $Lx = \lambda x$, the condition that x(t) be integrable-squared on $0 \leq t < \infty$, and the boundary condition $\sin\alpha \cdot x(0) - \cos\alpha \cdot x'(0) = 0$, for fixed α $(0 \leq \alpha < \pi)$, determine a non-trivial boundary problem H. Much of the paper is an investigation of the solutions of $Lx = \lambda x$ on $0 \leq t < \infty$ when λ is near zero, and through this, of the nature of the spectral function of H when λ is in a neighborhood of the origin. The results are then applied to a study of the related eigenfunction expansion of an arbitrary summable function f(t). (Author)

Purdue U., Lafayette, Ind.
A CHARACTERIZATION OF MULTICOHERENT PEANO SPACES, by A. Lauria and C. J. Neugebauer. Technical note no. 19 on Analytical Theory of Continuous Transformations, Contract AF 18(600)1484. Nov 59, 15p. 10 refs. AFOSR-TN-59-801.
Order from LC mi$2.40, ph$3.30 PB 144 753

Rome Air Development Center, Griffiss AFB, N. Y.
AN INTRODUCTION TO PROBABILITY THEORY DISCRETE SCHEMES, by F. M. Reza. Aug 59, 74p. 6 refs. RADC-TN-59-129.
Order from LC mi$4.50, ph$12.30 PB 144 485

In a recent report, considerable reliance on a background of probability theory was assumed. In view of the availability of some notes on discrete probability theory (based on a forthcoming book), it was felt desirable to publish these in technical note form. A report on nondiscrete probability may be published in the future. This report treats the fundamental notions of probability using modern concepts of set theory.

Statistical Techniques Research Group, Princeton U., N. J.
ON AN ITERATIVE METHOD FOR FINDING A LOCAL MINIMUM OF A FUNCTION OF MORE THAN ONE VARIABLE, by E. M. L. Beale. Technical rept. no. 25 on Contract DA 36-034-ORD-2297. Nov 58, 45p. 13 refs. OOR rept. 1715.23M.
Order from LC mi$3.30, ph$7.80 PB 144 817

A new approach to the problem of finding a minimum

(or at least a local minimum) of an arbitrary function of several variables is presented. This approach tends to reduce the number of function evaluations required to obtain an adequate approximation to the minimum, at the expense of considerable extra computation between evaluations. It is therefore considered appropriate in situations where each evaluation is a slow or costly process. A complete algorithm based on this approach is described, but some of the details may require modification in the light of further practical experience. (Author)

Virginia Agricultural Experiment Station, Blacksburg.
THE DEVELOPMENT OF STATISTICAL METHODS FOR EXPERIMENTAL DESIGNS IN QUALITY CONTROL AND SURVEILLANCE TESTING, by R. N. Pendergrass and R. A. Bradley. Technical rept. no. 5 (Final) on Ranking in Triple Comparisons, Contract Nonr-2352(01). Jan 59, 41p. 30 refs.
Order from LC mi$3.30, ph$7.80 PB 144 400

Paired comparisons are widely used in subjective testing. While small block-size designs are usually necessary, it is not always desirable to use paired comparisons. This paper deals with methods of analysis for the ranking of t treatments in sets or subsets of the possible $\binom{t}{3}$ triple comparisons formed from t treatments. A mathematical model for triple comparisons has been devised as an extension of the model for paired comparisons. Treatment parameters are postulated and estimated by the method of maximum likelihood and the asymptotic variances and covariances of these estimators are found. Test procedures are also derived. A brief numerical example is included. (See also PB 143 925)

Washington U., St. Louis, Mo.
INTEGRAL p-adic NORMAL MATRICES SATISFYING THE INCIDENCE EQUATION, by J. K. Goldhaber. Final technical rept. for 15 Oct 56-14 Oct 58 on Pairs of Matrices with Property L, Contract DA 23-072-ORD-1051. [1959] 9p. 11 refs.
Order from LC mi$1.80, ph$1.80 PB 138 577

Wayne State U., Detroit, Mich.
STATISTICAL TECHNIQUES IN LIFE TESTING. CHAPTER III. PROBLEMS OF ESTIMATION, by Benjamin Epstein. Technical rept. no. 4 on Contract Nonr-2163(00). 15 Jan 59, 106p. 11 refs.
Order from LC mi$5.70, ph$16.80 PB 144 401

It is frequently important that one make estimates of mean life, rates of failure, probability of survival for a given time, etc, on the basis of data arising from life tests. The data may be generated in many ways; e.g., they may arise from truncated, censored, sequential, replacement, non-replacement, interrupted, or combined experiments; we may or may not know the exact times to failure. We shall try in what follows to give rules and procedures which enable us to give point and interval estimates which are in some sense optimum.

Wisconsin U., Madison.
FOURIER TRANSFORMS OF GENERALIZED FUNCTIONS, by Jacob Kerevaar. Rept. on Contract N7onr-28507. Oct 58, 44p. 10 refs. AD-212 336.
Order from LC mi$3.30, ph$7.80 PB 144 433

Presented at the Symposium on Harmonic Analysis at Cornell U., Ithaca, New York, July 1956.

A symmetric theory of Fourier transforms is discussed for generalized functions or distributions. The class of distributions for which Fourier transforms are defined is the class of distributions of moderate growth. A fundamental sequence $[f_n]$ on $(-\infty,\infty)$ is said to be of moderate growth if there exist an integer $p \geq 0$, as a sequence $[f_n^{(-p)}]$ of antiderivatives of order p of the f_n, and constants A and a such that $|[f_n^{(-p)}(t)]| \leq A(|t|+1)^a$, $-\infty < t < \infty$, $n = 1, 2, \ldots$. A distribution ϕ is said to be of moderate growth if one of its defining fundamental sequences is. The class of distributions of moderate growth is characterized as the class of (generalized) derivatives $[F]^{(p)}$ of arbitrary order p of the integrable functions F which satisfy an inequality of the form $|F(t)| \leq B(|t|+1)^b$, $-\infty < t < \infty$.

Computing Devices

Applied Mathematics and Statistics Lab., Stanford U., Calif.
NUMERICAL METHODS FOR HIGH SPEED COMPUTERS: A SURVEY, by George E. Forsythe. Technical rept. no. 1 on Contract Nonr-225(37). 30 Jan 59, 22p. 20 refs.
Order from LC mi$2.70, ph$4.80 PB 144 556

Avion Div., ACF Industries, Inc., Alexandria, Va.
DESIGN OF A GENERAL PURPOSE DATA STORAGE SYSTEM, by Earl D. Gibson and Howard Knoer. Final rept. for 15 July 57-31 Oct 58 on Contract AF 19(604)2648. [1958] 138p. 44 refs. AFCRC-TR-58-189; AD-160 856.
Order from LC mi$6.90, ph$21.30 PB 138 424

This is the final report on a program of investigation, study, and design of a data storage system as a means of recording the data from a variety of analog computers in a form suitable for analytical study by digital computation. The problems associated with selecting the data to be stored and the sampling rates are considered. A highly flexible system which could be readily adapted to the needs of a wide variety of applications is presented. The basic functions of collecting digitizing, and storing the data are discussed along with several optional, special features. An alternate system is described along with several detailed approaches to some of the key problems.

Computation Lab., Harvard U., Cambridge, Mass.
DESIGN AND OPERATION OF DIGITAL CALCULATING MACHINERY. Rept. for 1 Dec 58-1 Mar 59 on Contract AF 19(604)4947. [1959] 36p. 2 refs. Scien-

tific rept. no. AF-53; AFCRC-TN-59-373; AD-217 826.
Order from LC mi$3.00, ph$6.30 PB 143 026

Contents:
Section 2. Aerodynamic origin of Magnus moment, by Edward Benton. [1958]
Section 3. Discrete array patterns, by James Misho. 10 June 58. Problem rept. no. 115.
Section 4. Tabulation of certain functions in capillary theory, by John W. Seward. 15 Nov 58. Problem rept. no. 116.
Section 5. Tables of spherical Bessel functions, by John W. Seward. [1958] Problem rept. no. 117.
Section 6. Airspeeds, altitudes and Mach numbers, by Charles King and Hugh Hawkes. Jan 55. Problem rept. no. 118.

Computation Lab., Harvard U., Cambridge, Mass.
DESIGN AND OPERATION OF DIGITAL CALCULATING MACHINERY. Rept. for 1 Mar-1 Sep 59 on Contract AF 19(604)4947. 1 Sep 59, 12p. Scientific rept. no. AF-56; AFCRC-TN-59-761.
Order from LC mi$2.40, ph$3.30 PB 144 590

This report concerns an investigation into the fluid mechanism responsible for the Magnus moment on a finned missile. Since almost no data is available on this matter, the object, during the period covered, has been to devise an experimental set-up for the direct measurement of Magnus moment. (See also PB 141 591)

Computation Lab., Harvard U., Cambridge, Mass.
DESIGN AND OPERATION OF DIGITAL CALCULATING MACHINERY. Rept. on Contract AF 19(604)4947. 1 Aug 59, 37p. Scientific rept. no. AF-55; AFCRC-TN-59-760.
Order from LC mi$3.00, ph$6.30 PB 144 591

The functions "x" and "z" which have been tabulated are the solution of the equations

$$\frac{dx}{d} = \rho \cos\phi$$

$$\frac{dz}{d\phi} = \rho \sin\phi$$

$$\frac{1}{\rho} + \frac{\sin\phi}{x} = 2 + \beta z$$

subject to the initial conditions

$$x = z = 0 \text{ and } \rho = 1 \text{ when } \phi = 0.$$

(See also PB 140 098)

David Taylor Model Basin, Washington, D. C.
704 PERTURBATION CALCULATION AML PROBLEM 840-121, by Maxine Jackson. Jan 58, 15p. Rept. 1166; reprint of Applied Mathematics Lab. Technical rept. 60.
Order from LC mi$2.40, ph$3.30 PB 138 431

The three group 704 Perturbation Calculation (P. S.) is a code prepared for the Knolls Atomic Power Laboratory to be used in connection with CURE, their 704 program for two-dimensional reactor design calculations.

General Electric Co., Schenectady, N. Y.
MEASURED RANGE ACCURACY OF THE HERMES A-3 DIGITAL COMPUTER AS AFFECTED BY (a) CERTAIN GUIDANCE SYSTEM TOLERANCES (b) WINDS AND FINITE GROUND LOOP RESPONSE, by P. G. Cushman and J. J. Weinstein. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 10 Sep 51, declassified 17 Mar 58, 15p. 3 refs. Technical information series no. DF 51A0520.
Order from LC mi$2.40, ph$3.30 PB 144 624

Deviations of the Hermes A-3 flight path from the standard trajectory in elevation and azimuth require small corrections to be made in the computed range of the missile. This study was made to determine if the corrections, corresponding to expected flight path deviations, were small enough to be neglected in the digital computer.

Michigan U., Ann Arbor.
LECTURES ON SWITCHING AND AUTOMATA THEORY, by Calvin C. Elgot. Rept. on Contracts Nonr-1224(21) and DA 20-018-ORD-16971. 1958, 80p. 62 refs.
Order from LC mi$4.50, ph$12.30 PB 144 451

These lectures include a study of two-terminal series-parallel relay contact networks, multi-terminal relay contact networks, and sequential networks. General, systematic techniques for the study of series-parallel networks have employed Boolean algebra or propositional calculus. A basic paper on multi-terminal relay contact nets makes use of matrices whose entries are elements of a Boolean algebra. More recent work makes use of the algebraic concepts: lattice, semi-group, group. The concept of ring when suitably specialized is intimately connected with Boolean algebras. This indicates the extent to which algebra is invading the mathematical theory of switching. Much recent work has employed more advanced aspects of logic than the propositional calculus. Indeed, the use of logic and its techniques has already produced significant results and promises still more fruitful ones.

National Research Labs., Ottawa (Canada)
REQUIREMENTS FOR A HYBRID ANALOG-DIGITAL COMPUTER, by D. C. Baxter and J. H. Milsum. Oct 59, 29p. 14 refs. Mechanical engineering rept. MK-7.
Order from LC mi$2.70, ph$4.80 PB 144 508

Conventional analog and digital computers are critically compared as to their relative suitability for scientific and engineering problems. Hybrid computers are defined as those in which computing operations of both types are combined, and the requirements are outlined for such a union to be advantageous. An economical, completely-general-purpose, hybrid computer seems unlikely, but there are many special purpose applications of advantage, and examples are given. (Author)

Stavid Engineering, Inc., Plainfield, N. J.
RESEARCH DIRECTED TOWARDS INSTALLATION, TESTING, DEVELOPMENT, AND MODIFICATION

OF EXPERIMENTAL DATA PROCESSING EQUIPMENT. Final engineering rept. on Contract AF 19(604)3503. Nov 59, 98p. 12 refs. AFCRC-TR-59-355; AD-228 308
Order from LC mi$5.40, ph$15.30 PB 144 425

This report describes the efforts of the contractor during a 17-month period in providing technical and engineering support necessary to the operation of a complex data processing system used as a tool in human research studies. It describes the system used, the problems encountered and their solutions, and the developmental tests toward improvement of equipment and simulation techniques. The report describes the use of equipment in two separate configurations: (1) the use of an experimental tactical air control center system with semi-automatic tracking, intercept, storage, and display provisions for component and system tests in human factor studies; and (2) through the experience gained, its eventual evolution and ultimate reinstallation into an advanced laboratory simulation facility for research on man/machine systems. In the latter configuration, the report places particular emphasis on various techniques used for the simulation and generation of complex tactical situations and corresponding methods of display, readout, and data reduction for purposes of threat evaluation and action selection. Thus, although intended for research in problems of military psychology, the information techniques employed are applicable and should be of interest to those concerned with systems of air traffic control, ground control of interceptors, missile launch, and control and command systems in general.

MECHANICS

Bolt, Beranek and Newman, Inc., Cambridge, Mass.
DAMPING OF BENDING WAVES IN MULTI-LAYER PLATES, by Gunther Kurtze. Rept. on Contract Nonr-2321(00). 27 Feb 59, 88p. 4 refs. Rept. no. 614.
Order from LC mi$4.80, ph$13.80 PB 144 819

Damping of structure-borne noise and vibration requires materials with high internal losses. Unfortunately homogeneous isotropic materials which combine the desired structural rigidity with a high loss tangent are not available for most applications. The desired damping, therefore, is usually obtained by various "damping treatments" in which dissipative coatings or layers are added to the structural elements. The analysis necessary for the design of such damping treatments involves the solving of a system of coupled differential equations, usually of the fourth order and, in addition, a considerable amount of algebra.

Brown U. Div. of Engineering, Providence, R. I.
AN EXPERIMENTAL STUDY OF PULSE PROPAGATION IN ELASTIC CYLINDERS, by D. Y. Hsieh and H. Kolsky. Technical rept. no. 4 on Contract Nonr-562(14). Oct 57, 11p. 9 refs. Nonr-562(14)/4.
Order from LC mi$2.40, ph$3.30 PB 138 909

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE FORMULATIONS OF CONSTITUTIVE EQUATIONS IN CONTINUUM PHYSICS, by A. C. Pipkin and R. S. Rivlin. Technical rept. no. 4, Jan 57-Sep 58, on Application of Invariance Principles in Continuum Mechanics, Contract DA 19-020-ORD-4531. Sep 58, 115p. 13 refs. DA-4531/4.
Order from LC mi$6.00, ph$18.30 PB 138 438

Constitutive equations prescribing a tensor of arbitrary rank in terms of displacement gradients and an arbitrary number of vectors are examined. The restrictions imposed upon such relations by form-invariance under rotation of the physical system are obtained. A method of finding the restrictions due to symmetries of the material is outlined, and this method is used in obtaining explicit results for seven groups of symmetry transformations.

Brown U. Div. of Applied Mathematics, Providence, R. I.
NOTE ON THE EXPANSION IN POWERS OF POISSON'S RATIO OF SOLUTIONS IN ELASTOSTATICS, by Eli Sternberg and Rokuro Muki. Technical rept. no. 6 on Contract Nonr-562(25). Feb 59, 12p. 13 refs. 562(25)/6.
Order from LC mi$2.40, ph$3.30 PB 144 823

This paper examines the power-series development with respect to Poisson's ratio of the solution to the second boundary-value problem (surface tractions prescribed) in three-dimensional classical elastostatics for the case of vanishing body forces. The individual terms of this expansion, by means of steady-state thermoelasticity theory, are found to admit an independent physical interpretation. This interpretation, in turn, permits certain conclusions concerning the dependence upon the elastic constants of solutions to space problems.

Brown U. Div. of Applied Mathematics, Providence, R. I.
ULTRASONIC ATTENUATION IN MILD STEEL UNDER DEFORMATION, by Raymond G. Bayer. Rept. on Contract AF 18(603)136. 15 Sep 58, 42p. 14 refs. AFOSR-TN-58-913; AD-204 567.
Order from LC mi$3.30, ph$7.80 PB 137 930

The losses in mild steel as a function of strain results from the combination of magnetic domain mechanisms and dislocation mechanisms. A heuristic model using known magnetic domain losses and known dislocation losses is proposed to explain the observed dependence.

Institute of Research, Lehigh U. [Bethlehem, Pa.]
PROPAGATION OF ELASTIC AND PLASTIC DEFORMATION IN SOLIDS, by C. W. Curtis. Annual rept. for 1 Sep 57, 31 Aug 58 on Contract DA 36-034-ORD-1456, Supplement 4. [1958] 17p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 138 475

Contributions to the theory of the propagation of elastic strain calculations to determine the effect of

varying the time-dependence of the applied pressure. Method of solving problems involving "mixed end conditions."

Michigan U., Ann Arbor.
THE TORSION OF SHAFTS OF VARYING CIRCULAR CROSS SECTIONS, by Hubert L. Hunzeker. Rept. on Contract AF 49(638)104. Oct 58, 85p. 36 refs. AFOSR-TN-58-738; AD-201 504.
Order from LC mi$4.80, ph$13.80 PB 137 839

Contents:
A shaft with a prolate ellipsoidal cavity
The torsion of a shaft with an oblate ellipsoidal cavity
Torsion of hyperboloids of revolution
The torsion of a semi-infinite shaft with a general monotone meridian section

Minnesota U., Minneapolis.
BEAM VIBRATIONS WITH QUASI-ORTHOGONAL BOUNDARY CONDITIONS, by Y. C. Das, L. E. Goodman and A. R. Robinson. Rept. for June-Dec 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5426. Nov 59, 46p. 8 refs. WADC Technical rept. 59-76.
Order from OTS $1.25 PB 161 348

An exact solution is developed for the transient and steady-state motion of beams when rotational or translational viscous damping enters the boundary conditions. The method is applicable to any structures whose governing differential equations and boundary conditions would, in the absence of energy dissipation, constitute a classical Strum-Liouville system. (Author)

Naval Ordnance Lab., White Oak, Md.
ROTATION INDUCED BY SINUSOIDAL EXCITATION, by Daniel Stern. 9 Sep 57, 26p. 14 refs. NAVORD rept. 5726; AD-157 273.
Order from LC mi$2.70, ph$4.80 PB 144 720

A freely supported rigid rod rests in a tube. The rod of outside radius r, and the tube of inside radius R, are both right circular cylinders. The longitudinal axes of the rod and tube are horizontal. If the tube receives transverse sinusoidal excitations, the rod usually bounces. However, for particular combinations of frequency and acceleration, it is possible for the rod to rotate without bouncing. Experimental results of various rod and tube models are reported. The locus of the rod's center during rotation is derived. A relationship between rotation and exciting frequency is derived. An expression for the period of rotation is developed. An approximate relationship for predicting rotation is also developed. (Author)

Royal Inst. of Tech. (Sweden).
MEASURING ACCURACY IN CREEP TESTS. PART II. INFLUENCE OF THERMAL STRESSES, by Arne Mellgren. Rept. for June-Dec 58 on Materials Analysis and Evaluation Techniques, Contract AF 61(052)05. Oct 59, 60p. 10 refs. WADC Technical rept. 59-78, Pt. 2.
Order from OTS $1.50 PB 161 356

In this report the author calculates the thermal stresses induced in cylinders and plates by non-uniform surface temperatures. The relations of thermal stresses to creep are then determined for cylindrical and sheet creep specimens. These relations are expressed mathematically for sinusoidal and square wave surface temperature gradients. Numerical examples are presented and discussed. (Author) (See also PB 151 928)

Aerodynamics and Pneumatics

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ON THE STABILITY OF ONE-DIMENSIONAL VISCOUS FLOWS: SOUND WAVES AND SHOCK WAVES, by Louis G. Kaufman, II and Morris Morduchow (Polytechnic Inst. of Brooklyn). Aug 59, 53p. 29 refs. WADC Technical rept. 59-355.
Order from OTS $1.50 PB 161 318

The solution to the steady one-dimensional Navier-Stokes equations is presented for the case of Prandtl number equal to 3/4 and constant coefficients of specific heats and viscosity. The solution has been shown to be valid for ordinary air flows with free-stream Mach numbers not exceeding about two. The unsteady flow solution is achieved by assuming a small one-dimensional perturbation of the steady flow and thence linearizing the equations. Solutions for the disturbance then vary exponentially with time. Two simultaneous ordinary differential equations for the velocity and temperature disturbances as functions of the space variable, with the complex damping or amplification factor as an eigenvalue depending on the disturbance wave length, are then derived. Disturbed uniform flows of both inviscid and viscid fluids are solved exactly; the resulting characteristic equations have eigenvalues with negative real parts which indicate that the disturbance decreases with time and hence that the uniform flows are stable. These results can be interpreted as indicating the speed of propagation and the rate of damping of one-dimensional sound waves with viscosity and heat conduction. Approximate methods are applied to obtain the characteristic equation for shock-wave flows. All of the several methods used here, which are essentially applications of the methods of collocation and of averages, yield the exact solution results for the special case of sonic flows, and all tend to predict instability for shock-wave flows. The analysis indicates, in particular, that for shock-wave flows there will always exist disturbance wave lengths, namely sufficiently large ones, for which the disturbances will tend to amplify with time. The instability is less pronounced, if at all present, for very small disturbance wave lengths (less than 10^{-4} inches for sea-level atmospheric conditions. (Author)

Aerophysics Development Corp., Santa [Barbara] Calif.
AN ACCOUNT OF RESEARCH INFORMATION

PERTAINING TO AERODYNAMIC HEATING OF AIRFRAME. BIBLIOGRAPHY, PART II, VOLUME II. MATERIALS, by John F. Brahtz and Allan Dean. Rept. on Contract AF 33(616)2328. Mar 55, 328p. 809 refs. WADC Technical rept. 55-99; AD-74 498.
Order from LC mi$11.10, ph$50.10 PB 144 695

Aerophysics Development Corp., Santa [Barbara] Calif.
AN ACCOUNT OF RESEARCH INFORMATION PERTAINING TO AERODYNAMIC HEATING OF AIRFRAME. BIBLIOGRAPHY. PART II, VOL. 4, METHODS ANALYSIS, by John F. Brahtz and Allan Dean. Rept. on Contract AF 33(616)2328. Mar 55, 99p. 343 refs. WADC Technical rept. 55-99; AD-74 500.
Order from LC mi$5.40, ph$15.30 PB 145 064

Contents:
Structural thermodynamic analysis
Loads and stresses
Structural allowables
Dynamic analysis
Creep theories
Thermal shock theories
(See also PB 144 695)

Aerophysics Development Corp., Santa [Barbara] Calif.
AN ACCOUNT OF RESEARCH INFORMATION PERTAINING TO AERODYNAMIC HEATING OF AIRFRAME. PART II. BIBLIOGRAPHY, VOLUME 5. METHODS OF TEST, by John F. Brahtz and Allan Dean. Rept. on Contract AF 33(616)2328. Mar 55, 87p. 289 refs. WADC Technical rept. 55-99; AD-74 561.
Order from LC mi$4.80, ph$13.80 PB 145 001

Contents:
Instrumentation
Fundamental engineering data - Experimental methods
  Atmospheric properties
  Heat transfer and fluid flow
  Materials properties
Developmental testing
Proof testing
Flight testing
(See also PB 144 695)

Arnold Engineering Development Center [Tullahoma, Tenn.]
CALIBRATION OF A 40-INCH CONTINUOUS FLOW TUNNEL AT MACH NUMBERS 1.5 TO 6, by C. J. Schueler and W. T. Strike. Rept. on ARO, Inc., Contract AF 40(600)800. Nov 59, 39p. 9 refs. AEDC-TN-59-136.
Order from LC mi$3.00, ph$6.30 PB 144 585

A test program was conducted to calibrate the von Karman Gas Dynamics Facility"s 40- by 40-in., continuous, supersonic wind tunnel (Tunnel A). Theoretical nozzle contours were adjusted, and local Mach numbers and flow angles were measured within a region of the test section. Results of the calibration at Mach numbers from 1.5 to 6 in half Mach number increments are presented. Included in the nozzle calibration program were tests of two typical models, AGARD Calibration Model B and a 15-deg cone cylinder.

Avco-Everett Research Lab., Mass.
FLIGHT MAGNETOHYDRODYNAMICS, by Arthur R. Kantrowitz. Rept. on Contracts AF 04(647)278 and 49(638)61. Mar 59, 20p. 6 refs. Research rept. 51; AFBMD-TN-59-27; AFOSR-TN-59-882.
Order from LC mi$2.40, ph$3.30 PB 144 785

A brief discussion is given of the possible flight applications of magnetohydrodynamics and the conditions under which they might be practical. A review of previous work is also given. (Author)

California U., Berkeley.
NONLINEAR PARABOLIC EQUATIONS: GENERALIZED FLOW OF GASES THROUGH POROUS MEDIA, by Avner Friedman. Technical rept. no. 3 on Contract Nonr-222(62). Jan 59, 30p. 14 refs.
Order from LC mi$2.70, ph$4.80 PB 144 553

Case Inst. of Tech., Cleveland, Ohio.
INITIAL BEHAVIOR OF A SPHERICAL RAREFACTION WAVE, by K. A. Faymon. Technical rept. no. 3 on Contract Nonr-1141(01). May 57, 158p. 17 refs.
Order from LC mi$7.50, ph$24.30 PB 138 998

The initial behavior of a spherical rarefaction wave is investigated by allowing an initially quiet gaseous sphere to expand into a vacuum. The ensuing motion in different regions of the x, t-plane is investigated by seeking solutions to the spherical equations of motion in the form of power series for the particle and sonic velocities.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
ROLLING PULLOUT STUDY. PART II: FLIGHT MEASUREMENT OF VERTICAL AND HORIZONTAL TAIL LOADS DURING A RUDDER LOCKED ROLLING PULLOUT MANEUVER, by D. W. Rhoads. Rept. on Contract W33-038-ac-18517. Jan 52, declassified 27 July 54. 415p. 5 refs. Rept. no. TB-451-F-4; AF Technical rept. no. 6701; ATI-204 300.
Order from LC mi$11.10, ph$63.60 PB 144 525

Flight tests have been conducted on an F-80A airplane for the basic purpose of determining the existing vertical and horizontal tail loads during a typical rudder locked rolling pullout maneuver. In addition to these basic quantities, recorded time histories of the control inputs, rolling and yawing velocities, sideslip angle, normal acceleration, and forward speed change are presented. The tests were made under a variety of geometric and aerodynamic configurations. Such quantities as load factor, Mach number, c.g. position, altitude and lateral moments of inertia were varied in order to present as complete a picture as possible of the responses to be expected under various plausible conditions. All of these tests were conducted well within the safe limits of the airframe, based on structural tests and standard safe load criteria. (See also PB 151 018)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
SHOCK TUBE DRIVER TECHNIQUES AND ATTENUATION MEASUREMENTS, by Charles E. Wittliff and Merle R. Wilson. Rept. on Contract AF 18(603)10. Aug 57, 39p. 9 refs. Rept. no. AD-1052-A-4; AFOSR-TN-57-546; AD-136 531.
Order from LC mi$3.00, ph$6.30 PB 144 652

The development of the hypersonic shock tunnel at the Cornell Aeronautical Laboratory, Inc. has been accompanied by a study of various techniques for producing strong shock waves to drive the shock tunnel. The results of this study are described as to technique and relative efficiency of different driver gases, and the resultant attenuation of the shock wave in the low pressure tube. It has been found that as the strength of the shock wave increases so does the amount of attenuation. Furthermore, the more efficient a given driver technique is in producing a shock wave, the larger the degree of attenuation that is observed. A survey of the presently available theories on shock wave attenuation indicates that the theories do not accurately predict the attenuation of shock waves having Mach numbers greater than 2, whereas all of the experimental data reported herein are for shock wave Mach numbers greater than 4. This serves to illustrate the need for a better understanding of the attenuation of strong shock waves. (Author)

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
AN INSTRUMENT FOR THE STUDY OF AERODYNAMIC FLOWS, by Wallis R. Grabowsky. Rept. on Contract Nonr-401(25). [1958] 34p. 6 refs.
Order from LC mi$3.00, ph$6.30 PB 144 457

Considerable progress in aerodynamic studies has resulted from the application of instruments measuring flow parameters. The hot wire, pitot tube, interferometer, and schlieren-photograph techniques have all proved to be invaluable assets in these studies. Each of these techniques has application in various free stream velocity ranges, the entire range going from supersonic to subsonic flow speeds. The instrument described was designed to determine quantitatively one flow parameter (the density) within the bounds of the following requirements: (1) It was to be applicable throughout the entire free stream velocity range of all the techniques listed above. (2) It was to extend considerably the lower free stream velocity limit of any of the techniques listed above. (3) It was not to interact with the flow pattern to such a degree that it would make the information obtained as a result of accomplishing requirement (2) difficult to interpret.

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
ON THE "TRIPLE POINT" IN SHOCK-DIFFRACTION PROBLEMS, by Tien-Fun Sun. Rept. on Contract AF 18(600)1523. Sep 56, 129p. 16 refs. AFOSR TN-56-583; AD-115 007.
Order from LC mi$6.30, ph$19.80 PB 138 687

The purpose of the present study is to determine the flow inside the diffracted wave, the position and the strength of the diffracted wave, and in particular how it reinforces or attenuates the incident or the reflected shock at the points - "triple points" where it intersects them.

David Taylor Model Basin, Washington, D. C.
THE DETERMINATION OF THE LOCAL SKIN FRICTION AND THE THICKNESS OF TURBULENT BOUNDARY LAYERS FROM THE VELOCITY SIMILARITY LAWS, by Paul S. Granville. Oct 59, 19p. 22 refs. Rept. 1340; AD-227 625
Order from LC mi$2.40, ph$3.30 PB 144 541

The applicability of pipe calibrations of Preston tubes to boundary layers is discussed on the basis of the logarithmic similarity law and the displacement effect of the tubes. A new logarithmic formula for the boundary-layer thickness of flat plates which is especially useful for high Reynolds numbers is also derived from the similarity laws.

Institute of Aerophysics, U. of Toronto (Canada).
INVESTIGATION OF FREE-MOLECULE AND TRANSITION FLOWS NEAR THE LEADING EDGE OF A FLAT PLATE, by E. L. Harris. Rept. on Contract AF 18(600)1185. Nov 58, 97p. 17 refs. UTIA rept. no. 53; AFOSR-TN-58-1043; AD-206 757.
Order from LC mi$5.40, ph$15.30 PB 144 754

Pressure measurements were made in the flow over a thin flat plate set parallel to the stream in the UTIA low-density wind tunnel. The length of the plate was approximately 7 mean free paths and free-stream speed ratios of 0.55 and 0.78 were used. Pressure measurements were obtained from forward- and backward-facing orifice-type probes, and wall taps. Reasonably good agreement was obtained between orifice impact-pressures measured less than one mean free path from the leading edge and a theoretical pressure calculated on the assumption that molecules entering the orifice probe came from the region upstream of the plate and from the plate surface after a diffuse reflection from it. That is, free molecule flow was shown to exist in a region less than one mean free path downstream from the leading edge.

Institute of Aerophysics, U. of Toronto (Canada).
MEASUREMENT OF TWO-POINT CORRELATIONS OF THE SURFACE PRESSURE ON A CIRCULAR CYLINDER, by V. Prendergast. Rept. on Contract AF 49(638)249. July 58, 32p. 3 refs. UTIA Technical note 23; AFOSR-TN-58-861; AD-203 674.
Order from LC mi$3.00, ph$6.30 PB 144 739

Results of an experimental investigation of the two-point correlations of the surface pressure on a circular cylinder are presented. The cylinder was mounted in a wind tunnel at right angles to the flow and contained within it the two microphones which were used as pressure transducers. The curves of correlation coefficient approached a constant asymptote (approximately 0.2), rather than zero at large hole spacing; this is tentatively regarded as a spurious environmental effect. The curves were accordingly adjusted to a zero asymptote. A plot of correlation

length v, Reynolds number, computed from the adjusted curves, has been presented. (Author)

Institute of Engineering Research, U. of California, Berkeley.
LOW DENSITY SUPERSONIC DIFFUSER PERFORMANCE, by Arthur M. Collins. Master's thesis. Rept. on Contract Nonr-222(45). 15 Jan 59, 49p. 22 refs. Rept. no. HE-150-164; Series no. 20, issue no. 126.
Order from LC mi$3.30, ph$7.80 PB 144 551

The impact pressure and static pressure recoveries of a supersonic, converging-diverging diffuser were measured in the range M = 1.7 - 4.1, Re_L 500 - 3200. The Reynolds number was with respect to the leading edge diameter. It was found that, for subsonic flow in the back end of the diffuser, normal shock static and impact pressure recoveries were the best that could be obtained. Afterglow photographs were taken of the low density flow inside the transparent plastic diffuser.

James Forrestal Research Center, Princeton, N. J.
INVESTIGATION OF THE INTERACTION OF A TURBULENT BOUNDARY LAYER WITH PRANDTL-MEYER EXPANSION FANS AT M 1.88, by K. R. Ananda Murthy and A. G. Hammitt. Rept. on Contract AF 18(600)498. Aug 58, 41p. 3 refs. Rept. no. 434; AFOSR-TN-58-839; AD-203 081.
Order from LC mi$3.30, ph$7.80 PB 144 580

An investigation has been made to study in detail the interaction of expansion fans with a two-dimensional supersonic turbulent boundary layer at a free stream Mach number of 1.88. The angle of expansion, which is the only parameter varied in this experimental set-up, varies from 5° to 30°. Schlieren photographs of the flow pattern have been taken to obtain an overall picture of this type of interaction. Static pressure and total head tube measurements have been made to study the interaction in detail. The method of rotational characteristics has been applied to the boundary layer velocity distribution as it expands around the corner to construct the flow field and to calculate the inviscid pressure distribution near the corner as a better approach to the problem than the classical Prandtl-Meyer flow.

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCHLIEREN EVALUATION OF A SHOCK TUBE FOR PRESSURE-GAGE PERFORMANCE, by Stuart M. Hauser. Rept. on Contract DA 04-495-ORD-18. 18 Nov 57, 54p. 13 refs. Rept. no. 20-115; AD-159 887.
Order from LC mi$3.60, ph$9.30 PB 144 716

In order to determine the origin of the nonperiodic noise appearing in gage-response records made with the gage-evaluation shock tube of the Jet Propulsion Laboratory, a schlieren system was set up at the end of the shock tube for photographing characteristics of the incident and reflected shock fronts, as well as the flow region following each. The schlieren light source had an effective flash duration of 0.5 μsec, producing schlieren pictures of the shock front which show no noticeable blurring. Sensitivity of the optical system was adequate for detecting pressure gradients as low as 5 psi/in. This was satisfactory for observing features of gage-response traces corresponding to noise steps as low as 5 psi, which occurred in a time less than 20 μsec. Although the shock tube does not produce clean, ideal aerodynamic flow, the investigation revealed that the undesirable features of gage-response records are not associated with observed nonideal characteristics of the shock front or of its interactions with the end of the shock tube. Consequently, it may be concluded that the shock tube is a satisfactory instrument for the investigation of the frequency response of pressure gages. The frequency range extends from 100 cps to well beyond 100,000 cps. (Author)

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
AN EXPERIMENT ON THE INSULATING PROPERTIES OF BOUNDARY LAYERS, by Frank H. Durgin. Rept. on Contract AF 18(603)82. July 59, 142p. 54 refs. Technical rept. 218; AFOSR-TN-57-392; AD-132 467.
Order from LC mi$7.20, ph$22.80 PB 144 422

An experimental investigation of the "insulating properties" of laminar and turbulent boundary layers has been conducted. The test was undertaken as part of a more general program in which the effects of mass transfer through a porous wall to a boundary layer are being studied. The purpose of the present test was to determine which of several theories was best able to predict the insulating properties of the boundary layer. The model was a cone. The forward half was cooled uniformly to about 100°F below recovery temperature. Theoretical methods due to Baron, Lighthill, and Libby and Morduchow have been used to predict the temperature decay over the aft part of the cone for the laminar case. Lighthill's theoretical results are in very close agreement with the experimental results. Methods due to Seban, Rubesin, and Hill have been applied to the turbulent case. The experimental results fall about halfway between the predictions of Seban and Rubesin. In calculating the theoretical results it is shown that the methods of Lighthill, Seban, Rubesin, and Hill can all be reduced to an integral of the same form and a solution for this integral is given.

National Research Labs., Ottawa (Canada).
AN EXPERIMENTAL STUDY OF ROTATING STALL IN A TWO-STAGE AXIAL COMPRESSOR, by R. F. Myer. Aug 59, 57p. 15 refs. Aeronautical rept. LR-259.
Order from LC mi$3.60, ph$9.30 PB 144 507

The stalling behaviour of an Orenda CT-100, experimental, two-stage axial compressor was studied at the constant operating speed of 3000 r.p.m. Rotating stall was observed to commence at a mass flow coefficient of 0.435 and as the mass flow was reduced several different patterns of rotating stall were observed. In two ranges of operation "steady" patterns consisting of three rotating stalls were observed, in two other ranges of operation rotating stall was observed but the stall patterns were continually changing, while for very

low mass flow operation the flow over the whole of the annulus appeared to be stalled. Reversed flow within the stalls was found to be an important feature of rotating stall. (Author)

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
THE HETEROGENEOUS, LAMINAR, BOUNDARY LAYER, by Judson R. Baron. Rept. on Contract AF 18(600)82. [June 57] 30p. 6 refs. Technical rept. no. 236; AFOSR-TN-57-398; AD-132 474.
Order from LC mi$2.70, ph$4.80 PB 145 023

Study is made of the general mass transfer situation for which the fluid introduced into the high speed boundary layer differs appreciably in physical properties from those of the external fluid flow. The descriptive system of equations are deduced from Enskog's solution of the Boltzmann equation and include provision for component mass conservation, energy migration resulting from specific enthalpy differences, and thermodynamic coupling between the transport phenomena. A similarity analysis is presented for laminar flows with and without pressure gradients and numerical results are given for helium and carbon-dioxide as foreign gases in a primarily air boundary layer flowing over a flat plate. It is shown that the injection of relatively low density fluid yields considerable alleviation of the thermal levels normally encountered at supersonic Mach numbers. A qualitative argument is offered to explain the effects on the basis of available thermal capacity. The related sublimation problem is considered briefly. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
THE USE OF HELIUM FOR COOLING NOZZLES EXPOSED TO HIGH TEMPERATURE GAS STREAMS, by Antonio Ferri and Paul A. Libby. Rept. on Contract AF 33(616)17. July 55, reissued Nov 58, 25p. 3 refs. WADC Technical note 55-318; AD-94 314.
Order from LC mi$2.70, ph$4.80 PB 144 903

The results of preliminary theoretical analysis and tests of the use of helium as a cooling gas in hypersonic wind tunnel and rocket motor nozzles are presented. The helium is introduced tangential to the exposed surface from a slot located where the local Mach number is about 0.4. Thereby, an insulating layer of helium is formed between the exposed surface and the high temperature gas stream. Helium appears to be the most appropriate insulating gas because of its high sonic velocity and because of its chemical inertness. The theoretical analysis indicates that the method should be applicable over a wide range of stagnation conditions.

Polytechnic Inst. of Brooklyn, N. Y.
ANALYSIS OF TIP-CLEARANCE FLOW IN TURBOMACHINES, by Chung Hua Wu and Wen Wu. Technical rept. no. 1 on Contract Nonr-839(04). July 54, 63p. 23 refs. AD-36 783.
Order from LC mi$3.90, ph$10.80 PB 145 033

A basic analysis of the blade tip flow phenomena is presented. The analysis is based on a steady relative flow of a viscous incompressible fluid. A rotating cylindrical coordinate system which moves with the blade at the same speed is used. An order-of-magnitude analysis reduces the basic equations to a set of simplified equations for both low and high Reynolds number. Expressions are given for the determination of the distributions of pressure and velocity in the clearance space and the mass flow across the tip clearance space. The computation of the velocity distribution is relatively simple and three methods of solution for the pressure distribution are presented. (Author)

University of Southern California. Engineering Center, Los Angeles.
SOME FURTHER RESULTS ON HEATING A SUPERSONIC GAS STREAM WITH A RADIO FREQUENCY DISCHARGE, by Frederick O. Smetana. Technical note on Contract AF 18(603)95. 1 Nov 59, 20p. 7 refs. Rept. 56-207; AFOSR-TN-59-1127.
Order from LC mi$2.40, ph$3.30 PB 144 781

Results of further experiments with RF discharge heating of a supersonic gas stream are reported. Temperature increases of at least 600°F were recorded although the presence of strong electrical fields made it extremely difficult to interpret temperature indications. The action of the ionized gas and the strong field limits the type of materials which may be used for nozzle materials. Qualitative indications of the decay of active species, N-N recombination, wall heating, effect of pressure, nozzle configuration, and electrode configuration were also obtained. (Author)

Hydrodynamics, Hydraulics, and Hydrostatics

California Inst. of Tech., Pasadena.
VISCOUS EFFECT ON SURFACE WAVES GENERATED BY STEADY DISTURBANCES, by T. Yae-tsu Wu and R. E. Messick. Rept. on Contract Nonr-220(28). Feb 58, 33p. 9 refs. Engineering Div. rept. no. 85-8; AD-154 372.
Order from LC mi$3.00, ph$6.30 PB 138 276

A linearized theory is applied to investigate the viscous effect on water waves generated and maintained by a system of external disturbances which is distributed over the free surface of an otherwise uniform flow. The flow is taken to be in the steady state configuration. The analysis is carried out to yield the asymptotic expressions for the surface wave when the Reynolds number of the flow is either large or small.

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
INTERFACIAL INSTABILITY OF FLUIDS OF ARBITRARY ELECTRICAL CONDUCTIVITY IN UNIFORM MAGNETIC FIELDS, by I. C. T. Nisbet. Rept. on Contract Nonr-401(25). [1958] 57p. 22 refs.
Order from LC mi$3.60, ph$9.30 PB 144 456

The stability to small sinusoidal disturbances of an infinite plane interface separating an electrically conducting fluid from a lighter non-conducting fluid is investigated in the case where both fluids are in-

compressible and inviscid, gravity and a uniform magnetic field act on the system permits study of the effects of variation of the conductivity of the upper fluid and the direction of the applied field.

Diamond Ordnance Fuze Labs., Washington, D. C.
DEVELOPMENT OF A SONIC FLOWMETER FOR STEEL PIPE, by Don R. Pardue, James C. McDade, and Frank Vrataric. 15 Dec 58, 49p. 5 refs. TR-663; AD-209 129.
Order from LC mi$3.30, ph$7.80 PB 144 635

The flowmeter described in this report was developed to measure flow rates from 3000 to 8000 gpm through a thick-walled steel pipe. The "upstream-downstream" method is used whereby the phase difference of an ultrasonic wave is measured in both directions to determine rate of flow. An FM system, whose modulation rate is equivalent to the delay time between transducers, is utilized to minimize undesirable "leakage" signals.

Institute of Engineering Research, U. of California, Berkeley.
A NOTE ON THE LINEARIZED DEEP WATER THEORY OF WAVE PROFILE AND WAVE RESISTANCE CALCULATIONS, by J. K. Lunde. Technical rept. no. 4 on Contract Nonr-222(30). Dec 57, 121p. 12 refs. Series no. 82, issue no. 4; AD-153 809.
Order from LC mi$6.30, ph$19.80 PB 138 110

Hydrodynamics Lab., Calif. Inst. of Tech., Pasadena.
OBSERVATIONS ON CAVITATION BUBBLE COLLAPSE, by Albert T. Ellis. Rept. on Contract N6onr-24420. Dec 52, 81p. 25 refs. Rept. no. 21-12; AD-7615.
Order from LC mi$4.80, ph$13.80 PB 145 035

The methods of generating bubble cavities which were studied included (1) pressure variation by flow over submerged bodies and (2) direct variation of the hydrostatic pressure. Observations were made in a high-speed water tunnel and in a small sample of stationary water. In the experiments, collapsing bubbles showed increasing departures from the spherical shape with decreasing radius. The collapse time of the bubbles was longer than predictions based on the extended Rayleigh theory. The theoretical explanation of this fact lies in the asymmetry of the collapse shapes. The general effect of large coupling between radial and translational bubble motion was to produce an increase in the translational motion in the direction of decreasing pressure. Rebounding and nonrebounding bubbles were observed. The latter type was believed to be a more important source of cavitation damage and noise than the bubbles containing permanent gas with their cushioned collapse. The observations indicated that bubble growth is more stable than bubble collapse.

St. Anthony Falls Hydraulic Lab., U. of Minnesota [Minneapolis]
EXPERIMENTAL STUDIES OF SUPERCAVITATING FLOW ABOUT SIMPLE TWO-DIMENSIONAL BODIES IN A JET, by Lorenz G. Straub and Edward Silberman. Proj. rept. no. 59 on Contract Nonr-710(24). Apr 58, 38p. 15 refs.
Order from LC mi$3.00, ph$6.30 PB 138 550

A two-dimensional free-jet water tunnel is described briefly. Results of experimental measurements on a two-dimensional cup, symmetrical wedges, inclined flat plates, and a circular cylinder in the tunnel are given. Measured force coefficients at zero cavitation number are in good agreement with theory. Shapes of the cavities were computed for one of the wedges and for one of the plates at zero cavitation number; the observed shapes are also in good agreement with the theory.

METALLURGY

Battelle Memorial Inst., Columbus, Ohio.
HIGH-TEMPERATURE-ALLOY CUTTING PROGRAM, by J. E. Clifford, D. E. Semones, and J. McCallum. Final engineering rept. on Contract AF 33(600)35440. 18 Jan 59, 153p. 11 refs. AMC TR-59-7-617; AD-210 979.
Order from LC mi$7.50, ph$24.30 PB 144 650

New methods for cutting high-temperature alloys included chemical machining, chemical cutting by high-velocity jets, abrasive slurries, ultrasonics, electro-arc and electrospark machining, explosive cutting, and electrolytic machining. Multiple cutoff by electrolytic machining was selected for development. A survey made of industrial methods for billet cutoff permitted economic comparisons of new with existing methods and pinpointed important specifications.

Kaiser Aluminum and Chemical Co., Spokane, Wash.
THE IMPROVEMENT IN WELD SOUNDNESS BY THE USE OF HALOGENS AND HALIDES IN INERT GAS METAL ARC WELDING OF ALUMINUM, by A. R. Pfluger and M. B, Kasen. Phase rept. 1 on Welding of High Strength Aluminum Alloys, Contract DA 04-200-ORD-333. 30 Dec 55, 72p. 2 refs. Interim project rept. no. MS PR 55-68; AD-107 075.
Order from LC mi$4.50, ph$12.30 PB 144 646

A study was made of the effect of the additions of Cl, $AlCl_3$, $MgCl_2$ or $TiCl_4$ to the arc area during the inert gas metal arc (MIG) welding of Al alloys. Chlorine was added to the argon shielding gas in amounts of 0.05 to 0.25 vol-% and resulted in improvement in weld soundness and an increase in the tensile strength and ductility of the weld metal. Plates, 1/2 and 3/4 in. thick, were used in the tests. The optimum Cl addition was 0.063% for a total shielding gas flow of 60 cu ft/hr. A reduced quantity of dross and entrained (gas) porosity in the weld was accomplished. Excessive spatter was noted during the MIG welding of Al alloys containing Mg when welded in the presence of halide or halogen additions to the arc area. The use of shorter arc lengths (arc voltage) and higher currents decreased the tendency of the spatter to agglomerate into globules. Difficulty was encountered in attempts to introduce $AlCl_3$ into the weld area. Welds made with a

cored wire containing 1/2% $MgCl_2$ compared favorably with welds achieved by the use of Cl additions to the shielding gas but produced a great amount of spatter and an erratic arc. The use of $TiCl_4$ additions to the protective atmosphere resulted in increased weld soundness and gave better arc characteristics than were obtained by using Cl, $AlCl_3$, or $MgCl_2$.

Lockheed Aircraft Corp., Sunnyvale, Calif.
ELECTRON BOMBARDMENT MELTING AND CASTING OF BERYLLIUM, by H. T. Sumsion and C. O. Matthews. Rept. on Contract NOrd-17017. 7 Nov 58, 44p. 4 refs. LMSD-48330; AD-208 004.
Order from OTS $1.25 PB 161 327

Electron-bombardment furnace and process for melting and casting 3-inch diameter beryllium ingots are described. The ultimate objective is to produce a beryllium or beryllium-alloy ingot which can be fabricated into plate. Initial metallurgical evaluations of the cast ingots have been made by visual inspection, metallographic examination, chemical and X-ray diffraction analyses, machinability, hardness, tensile, and bend tests. Effect of variations in melt stock and process variables, including composition, on ingot structure have been investigated. Data are given for ingots evaluated to date

Powder Metallurgy Lab., Stevens Inst. of Tech., [Hoboken, N. J.]
A SURVEY OF ULTRA FINE POWDERS AND POWDER MIXTURES, by Frank W. Heck, Donald P. Ferriss, and others. Final rept. on Subcontract NOas-54-519. 30 Nov 56, 28p. 6 refs.
Order from LC mi$2.70, ph$4.80 PB 145 029

Cooling pyrophoric iron and mixed ultra-fine powders to about -25°F permits their being safely handled and compacted in air. A method of reducing oxygen in these powders to less than 0.02% without sintering has been devised. Some experimental powders exhibit unusual strength and/or ductility after simple compacting and sintering. Others require hot pressing or hot coining to establish solid state bonding. (Author)

Titanium Metallurgical Lab., Battelle Memorial Inst., Columbus, Ohio.
THE DETERMINATION OF HYDROGEN IN TITANIUM AND ITS ALLOYS; A CRITICAL REVIEW, by T. D. McKinley (E. I. du Pont de Nemours & Co.). 23 Sep 57, 25p. 27 refs. Titanium Metallurgical Lab. memo.
Order from LC mi$2.70, ph$4.80 PB 144 564

Theory, operational characteristics, and indicated precision and accuracy of analytical methods based on vacuum extraction, equilibrium pressure, and combustion approaches are reviewed. At the present time, vacuum extraction at 1400 C and the equilibrium pressure method are recommended for determination of hydrogen in titanium and titanium-rich alloys.

Utah U., Salt Lake City.
KINETICS OF OXIDATION OF METAL POWDERS, by Harold H. Boehm and H. Edward Flanders. Technical rept. no. 3 on Contract DAI 04-495-501-ORD(P)-19. 16 May 58, 75p. 23 refs. AD-208 077.
Order from LC mi$4.50, ph$12.30 PB 144 562

When spherical magnesium particles were oxidized below the ignition temperature in a range of 400-600° C, it was observed that internal oxidation amounted to a larger percentage than external scale formation. Density determinations were undertaken before and after oxidation of the particles in an effort to study the mechanism of internal oxidation.

Ferrous Metals

Crucible Steel Co. of America, Pittsburgh, Pa.
DEVELOPMENT OF HIGH-TEMPERATURE IRON-BASE ALLOYS, by A. Kasak, V. K. Chandhok, and E. J. Dulis. Rept. for Apr 58-May 59 on Metallic Materials, Contract AF 33(616)5428. Oct 59, 71p. 5 refs. WADC Technical rept. 59-353.
Order from OTS $2.00 PB 161 337

An investigation was conducted to develop steels that have very high strengths at ambient temperature and at temperatures approaching 1200 F. The results show that with proper balancing of the composition and optimum heat-treatment the objective of the program could be attained. Up to 1100 F the steels developed had higher strengths than any other steel known today. The highest strengths were obtained on steels that contained 0.35-0.40% C, 7-9% Cr, 0.5-1.0% V, 5-7% Mo, 5-8% Co, up to 1% Ti, up to 1% Ta+Cb, up to 1.5% W, and up to 0.01% B. One steel that contained 0.36% C, 7.72% Cr, 1.15% V, 5.71% Mo, 4.93% Co, and 0.009% B had a tensile strength of 310,000 psi at room temperature and 201,000 psi at 1100 F; the 100-hr creep-rupture strength at 1100 F was 98,000 psi. Also, excellent strengths were obtained at 1200 F. Beneficial effects on strength and ductility were sometimes derived from using a novel heat-treating schedule. Microscopic studies indicated that the fracture behavior and the creep-rupture strength were significantly influenced by the formation and coalescence of carbides at the grain boundaries. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF HIGH-STRENGTH STEELS BY WORKING OF METASTABLE AUSTENITE, by F. R. Morral. 30 Nov 59, 24p. 18 refs. DMIC memo. 39.
Order from OTS $0.50 PB 161 189

On hot-cold-worked steels, as in steels conventionally heat treated to martensite, there is a trend of rising strength and falling ductility with increasing carbon content. The greater the deformation of the metastable austenite, the better the yield and tensile strength properties. Tensile strengths of 400,000 psi have been obtained with deformations on rolling of the order of 90 per cent reduction in cross section. For the aircraft and missiles industries, the steels containing 0.30 to 0.40 carbon seem to be the most suitable. The effect of particular alloying elements on

the behavior of the deformed metastable austenite is not known. The tempering sequence depends on the steel used. If subcritical deformation of metastable austenite is to become a commercial process, development of plant techniques is necessary. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
DRILLING HIGH-STRENGTH STEELS HEAT TREATED TO 330 TO 560 BRINELL HARDNESS, by A. F. Gerds, Carl T. Olofson, and F. W. Boulger. 24 Aug 59, 17p. 4 refs. DMIC Memo-31; AD-225 672.
Order from OTS $0.50 PB 161 181

Successful drilling of hardened steels requires adequate power, rigidity, and appropriate drills. Drilling speeds and feeds range from 7 to 40 feet per minute, and 0.0005 to 0.005 inch per revolution, respectively. Feeds must be positive. Idling in the hole without cutting work hardens the steel below the drill point, making further drilling virtually impossible. Rigid setups between work and drill, and the use of short, heavy-duty drills are emphasized. These factors increase drill life and hole accuracy, and frequently allow the use of less expensive high-speed steel drills. A backup plate is often important for added support, especially when drilling through holes. The composition and geometry of the drill have pronounced effects on successful drilling of high-strength steels, but the available information does not warrant specific recommendations on these two factors. This report, however, describes conditions and tools which were reported to be suitable for use with various workpieces. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
HEAT TREATMENT OF HIGH-STRENGTH STEELS FOR AIRFRAME APPLICATIONS, by R. J. Fiorentino, D. B. Roach, and A. M. Hall. Rept. on Contract AF 18(600)1375. 27 Nov 59, 111p. 29 refs. DMIC rept. 119.
Order from OTS $2.50 PB 151 076

This report is a summary of the information gathered from four steel producers and twenty-four steel consumers on the status of the heat treatment of high-strength steels for airframe applications. The materials covered in the report are (1) the low-alloy hardenable engineering steels, (2) the hot-work die steels (3) the martensitic stainless steels, (4) the martensitic precipitation-hardenable stainless steels, (5) the semi-austenitic precipitation-hardenable stainless steels, (6) the austenitic precipitation-hardenable stainless steels, and (7) the cold-rolled austenitic stainless steels. The topics covered under each material include illustrative heat treatments, uses, fabrication, atmospheres, protective coatings, cleaning, and descaling. Also included is a list of some large-capacity heat-treating-furnace equipment available throughout the country. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
MECHANICAL- AND PHYSICAL-PROPERTY DATA ON MODIFIED 12 PER CENT CHROMIUM MARTENSITIC STAINLESS SHEET STEELS FOR AIRFRAME APPLICATIONS, by J. G. Hoag, D. B. Roach, and A. M. Hall. 18 Apr 59, 56p. 1 ref. DMIC memo. 15.
Order from OTS $0.50 PB 161 165

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
MILLING OF HIGH-STRENGTH STEELS IN THE HARDNESS RANGE OF 330-560 BRINELL, by C. T. Olofson. 17 Aug 59, 40p. 30 refs. DMIC memo. 30; AD-225 673.
Order from OTS $0.50 PB 161 180

Carbide tool materials best suited for use include the C-2, C-3, C-6, and C-7 grades. Carbide cutter design utilizes 0- and 15-degree negative rake angles, depending on the hardness of the steel being milled. Corner angles from 30 to 45 degrees are employed to lengthen the cutting edge so uniform tool wear is obtained. Relief angles from 6 to 10 degrees are used as a compromise between the best cutting-edge support and the longest tool life per tool regrind. Carbide cutters, operating at 0.001 to 0.010 inch per tooth feed and at depths of cut up to 0.10 inch, employ cutting speeds between 50 and 700 feet per minute, depending on the milling operation and the hardness of the steel. High-speed-steel cutters appropriate for milling high-strength steels include the molybdenum types of M-3, Type 2, M-10, M-4, and M-7, and the cobalt grade, M-34. Tungsten high-speed steel with 5 per cent cobalt (T-15) seems to give the best tool life, on the basis of limited data. High-speed-steel cutter design employs 0- to 35-degree positive rake angles, 30- to 45-degree corner angles, and 5- to 10-degree clearance angles, depending on the milling operation. These tools operate at feeds between 0.001 and 0.010 inch per tooth, depths of cut up to 0.25 inch, and speeds between 6 and 120 feet per minute. (Author)

Martin Co., Baltimore, Md.
AUTOCLAVE TESTING OF TYPE 304 STAINLESS STEEL, ADDENDUM, by L. Frank and P. Eisenberg. Addendum to Contract DA 44-009-eng-3043, Task 1, phase 2. Nov 58, 15p. 6 refs. MND-E-1322-I; AD-209 929.
Order from LC mi$2.40, ph$3.30 PB 144 522

The oxygen concentration in the steam phase should be the prime concern in relation to environmental conditions contributing to stress corrosion cracking. Strain gage measurements were made on U-bend specimens used in the autoclave tests. Stress values resulting from loading the specimen ranged to about 39,000 psi in the bend. (See also PB 151 149)

Light Metals

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
HEAT CAPACITY OF BERYLLIUM, by J. W. Holladay. 19 Oct 59, 11p. 23 refs. DMIC memo. 36.
Order from OTS $0.50 PB 161 186

This memorandum collects the data available to the Defense Metals Information Center on the heat capacity of beryllium. Heat capacity as a function of temperature and the effect of impurities on the heat capacity are discussed.

James Forrestal Research Center, Princeton U., N. J.
THE THERMODYNAMIC ACTIVITY OF CADMIUM IN MAGNESIUM-CADMIUM ALLOY, by Richard J. Borg and C. Ernest Birchenall. Technical rept. no. 2 on Contract Nonr-1858(08). 16 Apr 58, 12p. 8 refs. Metallurgy rept. no. 15.
Order from LC mi$2.40, ph$3.30 PB 138 612

Vapor pressures for eight compositions of Mg-Cd have been determined by the Knudsen effusion technique. Measurements were made at several temperatures for each alloy and the results interpolated to a common temperature for the calculation of the activities. (See also PB 138 899)

New York U. Coll. of Engineering, N. Y.
THE INFLUENCE OF PRIOR PLASTIC STRAIN AND INTERSTITIAL CONTENT ON THE AGING BEHAVIOR AND MECHANICAL PROPERTIES OF ALPHA-BETA TITANIUM ALLOYS, by R. F. Bunshah. Final rept. on Contract DA 30-069-505-ORD-1779. Aug 58, 103p. 21 refs. WAL no. 401/258; AD-210521.
Order from LC mi$5.70, ph$16.80 PB 144 561

A study of the effect of prior plastic strain on the aging behavior of Ti-8Mn & Ti-16V base alloys at various interstitial levels. The influence of interstitials in both sets of alloys is to increase the maximum hardness produced on aging. In the Ti-8Mn base alloys, the addition of 0.2%O_2 to the base composition delayed the overaging process. 0.1% C addition acted the same way. The addition of 0.015%H_2 and 0.025%H_2 increased the initial aging rate and the over aging rate.

Nonferrous (except light) Metals

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
A BRIEF REVIEW OF REFRACTORY METALS, by R. I. Jaffee. 3 Dec 59, 37p. 24 refs. DMIC memo. 40.
Order from OTS $0.50 PB 161 190

In this paper the refractory metals will be taken as the metals with melting points equal to or higher than that of chromium, 1875 C.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
FABRICATION OF PURE COLUMBIUM, by W. D. Klopp and Webster Hodge. 11 Sep 59, 9p. 10 refs. DMIC memo. 34; AD-226 046.
Order from OTS $0.50 PB 161 184

The fabrication of pure columbium is readily carried out cold with conventional tools. Precautions must be taken, when extreme-pressure processes are used, to prevent sticking by the use of very smooth die finishes and proper lubricants. Since the metal is rapidly contaminated by all common gases at elevated temperatures, welding operations must be performed in an atmosphere of helium or purified argon, and annealing operations in a high vacuum. Solid-solution alloys may be handled, in general, like pure columbium. (Author)

Sylvania Research Labs., Bayside, N. Y.
STUDY OF THE PROPERTIES OF ULTRA PURE NICKEL, by G. W. Hees, L. Castleman and G. H. Morrison. Scientific rept. no. 1 for 1 Jan-30 Sep 59, on Contract AF 19(604)5213. 15 Dec 59, 43p. 8 refs. TR59-104-205-704.3; AFCRC-TN-59-966.
Order from LC mi$3.30, ph$7.80 PB 144 972

The floating zone technique is an excellent method for melting nickel without risking contamination from a crucible and thus can be used to consolidate the chemical extraction product and remove volatile impurities. A survey was made of chemical methods of purification of nickel. The general techniques that were investigated included solvent extraction, ion exchange, precipitation and electrodeposition. Various trace analytical techniques are discussed with the relative applicability of each to the determination of trace impurities in high purity nickel.

Structural Metallurgy and Corrosion

Crest Research Labs., Inc., Santa Fe Springs, Calif.
MECHANISM OF CORROSION AND CORROSION INHIBITION OF STEEL IN WEAK ACID SOLUTION: DETERMINATION OF QUANTITATIVE LOCAL CELL POLARIZATION CURVES, by Willard R. Scott, Gilson H. Rohrback and Harold A. Parker-Jones. Final technical rept. on Contract Nonr-2113(00). 2 Feb 59, 124p. 30 refs.
Order from LC mi$6.30, ph$19.80 PB 144 576

An apparatus and a procedure were developed for precise measurement of the mixed electrode potential, interface resistance, and interface capacitance of a corroding metal surface in the presence of polarizing current. Studies were made on mild steel corroding freely in oxygen-free salt water at pH 4 - 6, and on this electrode in the presence of several different types of corrosion inhibitors.

Crucible Steel Co. of America, Pittsburgh, Pa.
DEVELOPMENT OF A CORROSION-RESISTANT

BEARING STEEL FOR SERVICE IN AIRCRAFT AT TEMPERATURES UP TO 1000F, by G. Steven and T. V. Philip. Rept. for Apr 58-July 59 on Metallic Materials, Contract AF 33(616)5428. Oct 59, 70p. 10 refs. WADC Technical rept. 59-390.
Order from OTS $1.75 PB 161 338

Corrosion resistance has been added to the high initial hardness, adequate temper resistance (600-900 F), and good dimensional stability of a high-speed type bearing alloy. To produce secondary hardening, the base composition of a quench hardenable stainless steel, 440C, was modified with V, W, Mo, and Co. The following composition is recommended for use as a stainless bearing steel for 500 hr of operation up to 900 F: 1.10-1.15% C, 0.15% max Mn, 0.15% max Si, 13.5-14.5% Cr, 2.5-3.0% V, 2.0-2.5% W, 3.75-4.25% Mo, 5.0-5.5% Co. For best performance, the steel should be heat-treated as follows: heat to 2200 F, oil quench, and refrigerate to -105 F. Rockwell "C" 66 is achieved (2% retained austenite) by tempering the steel for 1+1+2 hr at 1000 F with intermediate sub-zero cooling after the first and second draws. Tempering twice for 2 hr at 1000 F also results in a useful structure. After 500 hr at 900 F the hardness drops to R_C 65 (hot hardness of R_C 57), and the structure contracts 13 μin./in. After three cycles of a water-vapor corrosion test, the surface of fully heat-treated WADC66 is only slightly more pitted than that of annealed 430 stainless steel. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PROCEDURES FOR ELECTROPLATING COATINGS ON REFRACTORY METALS, by John G. Beach and John A. Gurklis. 9 Oct 59, 28p. 37 refs. DMIC memo. 35.
Order from OTS $0.50 PB 161 185

The purpose of this memorandum is to bring together a partial selection of procedures that have been employed to electroplate various metals onto the refractory metals, in an attempt to answer the question of how to produce sound, adherent electroplates on the refractory metals. Refractory metals covered are: vanadium, columbium, tantalum, tungsten, titanium, and molybdenum.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PROCEDURES FOR THE METALLOGRAPHIC PREPARATION OF BERYLLIUM, TITANIUM, AND REFRACTORY METALS, by R. D. Buchheit and G. A. Wheeler. 26 Oct 59, 38p. 1 ref. DMIC memo. 37.
Order from OTS $0.50 PB 161 187

It is the purpose of this memorandum to provide some basic information for such companies who wish to establish and practice satisfactory procedures for the metallographic preparation of the following metals: beryllium; chromium; columbium; molybdenum; platinum group: platinum, palladium, ruthenium, rhodium, iridium, and osmium; rhenium; tantalum; titanium; tungsten; and vanadium.

Dynamic Properties Lab., Calif. Inst. of Tech., Pasadena.
STUDY OF THE YIELD PHENOMENON IN ZINC SINGLE CRYSTALS, by K. R. King. Technical note no. 4 on Contract AF 18(600)490. Nov 58, 28p. 8 refs. AFOSR-TN-58-1023; AD-162 288.
Order from LC mi$2.70, ph$4.80 PB 137 812

Static and rapid loading shear tests on single crystals of 99.99+ per cent purity zinc were performed. A system was devised for the testing of single crystal specimens in compression which produces a uniform shear stress on the slip planes suitable for rapid load testing as well as static testing. Distinct upper yield points are exhibited by annealed specimens tested in compression.

Engineering Materials Research Lab., Brown, U., Providence, R. I.
A THEORY OF THE NON-LINEAR INFLUENCE OF NORMAL STRESS ON FATIGUE UNDER COMBINED STRESSES, by J. D. Coleman and W. N. Findley, Masters thesis. Technical rept. no. 4 on Basic Research on Fatigue Failures under Combined Stress, Contract DA 19-020-ORD-3520. Nov 56, 31p. 14 refs. EMRL-5; OOR rept. 1348.5E; AD-117 366.
Order from LC mi$3.00, ph$6.30 PB 137 865

The possible effect of anisotropy is considered. A non-linear theory is developed and compared with other theories and with results of tests of SAE 4340 steel at a hardness of Rockwell C-25.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
DISLOCATIONS IN DEFORMED SINGLE CRYSTALS OF ALPHA BRASS. PART I. GENERAL OBSERVATIONS, by J. D. Meakin and H. G. F. Wilsdorf. Rept. on Contract AF 49(638)162. Dec 59, 28p. 33 refs. Interim rept. I-A2027-1; AFOSR-TN-59-1047; AD-229 609.
Order from LC mi$2.70, ph$4.80 PB 144 570

Using a combined decoration and etching technique the dislocation structure of annealed and deformed α-brass has been studied. Using slip line data, the mean path of a dislocation and the configuration of groups along an active slip plane have been deduced.

James Forrestal Research Center, Princeton, N. J.
KINETICS OF FORMATION OF POROUS OR PARTIALLY DETACHED SCALES, by C. E. Birchenall. Rept. on Contract AF 18(600)967. July 54, 30p. 2 refs. Metallurgy rept. no. 1; OSR-TN-54-286, AD-49 866.
Order from LC mi$2.70, ph$4.80 PB 144 557

This report examines the variety of kinetic relations which may be found for the oxidation of solid metals when porosity forms in the oxide or at the metal-oxide interface according to several systematic procedures. Particular attention is given to the time sequence in which various rate laws may govern the process. The need for more careful correlation of microstructures with rate measurements is emphasized. The possible role of plastic deformation is also considered. (Author)

Minerals Research Lab., U. of California, Berkeley.
ACTIVATION ENERGIES FOR CREEP OF SINGLE ALUMINUM CRYSTALS FAVORABLY ORIENTED FOR CUBIC SLIP, by Y. A. Rocher, L. A. Shepard, and J. E. Dorn. Technical rept. no. 5 on Contract Nonr-222(49). 20 Dec 57, 23p. 16 refs. Series no. 103, issue no. 5; AD-153 469.
Order from LC mi$2.70, ph$4.80 PB 138 112

Creep activation energies for single aluminum crystals favorably oriented for shear by (010) [101] glide were determined over the temperature range from 78° to 900°K. From 800° to 900°K, unusually high activation energies ranging from 28,000 to 54,000 cal./mole were obtained. The maximum activation energy was attributed to recrystallization.

Naval Boiler and Turbine Lab., [Philadelphia, Pa.]
FUEL OIL ASH CORROSION RESISTANCE OF CHROMIUM METAL, by J. R. Witmeyer. Evaluation rept. 29 July 57, 22p. (1 color photograph will not reproduce) NBTL Test R-255; AD-147 471.
Order from LC mi$2.70, ph$4.80 PB 144 919

Relative corrosion resistance of commercially pure chromium metal and 25Cr:20Ni, alloy to synthetic fuel oil ash was tested using high vanadium and high sodium corrodents, at 1700, 2000 and 2200 F The chromium showed better corrosion resistance than 25Cr:20Ni. Cyclic tests at 2000 F revealed the poor oxidation resistance of the chromium compared to 25Cr:20Ni. Brittleness and grain growth increased as the temperature. (Author) (See also PB 136 267)

Naval Engineering Experiment Station, Annapolis, Md.
SEA WATER CORROSION OF VARIOUS MATERIALS TESTED IN SEVEN 20-TUBE MODEL CONDENSERS, by J. L. Basil and J. S. Whelan. 21 Mar 58, 142p. 6 refs. Research and Development rept. 910027A.
Order from LC mi$3.30, ph$7.80 PB 144 651

Seven 20-tube model condensers were tested for corrosion and erosion resistance by pumping natural sea water through the tubes at 10 ft/sec. One was an all-aluminum condenser. The others had 70-30 and 90-10 copper-nickel tubes with water boxes and tube sheets of various alloys. The report describes the condition of the units after destructive examination.

New York U. Coll. of Engineering, N. Y.
MINIMIZATION OF THE INFLUENCE OF RESIDUAL HYDROGEN ON BRITTLENESS IN ALPHA-BETA TITANIUM ALLOYS, by P. A. Farrar and H. Margolin. Final rept. on Contract NOas-55-955-d. Oct 59, 93p. 22 refs.
Order from LC mi$5.40, ph$15.30 PB 144 575

The Ti-10%Mo-H system was investigated. The effect of variation of amounts of α and β in Ti-Mn alloys on the embrittlement by hydrogen has been investigated, using the Ti-3, 8 and 12%Mn alloys. The effect of heat treatments at temperatures above the eutectoid temperature of the Ti-H system have been investigated for the Ti-6Al-4V-H alloys after prior plastic strain.

Northwestern Technological Inst., Evanston, Ill.
THE STRENGTH OF ALUMINUM SILVER ALLOYS, by Anthony Kelly. Rept. on Contract AF 18(600)1468. 7 Nov 58, 5p. 9 refs. AFOSR-TN-58-912; AD-204 568.
Order from LC mi$1.80, ph$1.80 PB 137 847

Single crystals of aluminum - 6 at.% silver quenched from the δ-phase field and aged at room temperature show a critical resolved shear stress at 0°C of 7-8 kgs. mm.$^{-2}$

Rensselaer Polytechnic Inst., Troy, N. Y.
PROPERTIES OF MAGNESIUM AND MAGNESIUM ALLOY SINGLE CRYSTALS AT ROOM AND OTHER TEMPERATURES, by E. D. Levine, W. F. Sheely and R. R. Nash. Final rept. for 1 July 54-31 Dec 57 on Contract DA 30-115-ORD-546. 30 Apr 58, 163p. 62 refs. AD-200 875.
Order from LC mi$7.80, ph$25.80 PB 144 529

Single crystals specimens of magnesium and magnesium alloys containing indium, cadmium, thallium, aluminum, zinc, lithium, and thorium were prepared in both cylindrical and spherical form. Examination of stress-strain curves illustrated that the most important factor in solution strengthening of these alloys is an interaction between solute atoms and substructural boundaries in the crystals.

Rock Island Arsenal Lab., Ill.
EMULSIFIABLE AND FIRE RESISTANT RUST PREVENTIVES, by Van Y. S. Hong. 21 Apr 59, 73p. 44 refs. Rept. no. 59-1103; AD-214 943.
Order from OTS $2.00 PB 161 352

An emulsifiable and fire resistant type of rust preventive compound was developed. Suitable test methods and requirements were evolved for the evaluation of this type of material. Protection afforded to Ordnance materials, such as small hardware items under accelerated weather conditions, was found to be adequate. Advantages of this type of material over current types of rust preventive compounds were ascribed to their fire resistant property, protection efficiency, and economy. A discussion of the limitations of this type of compound from the standpoint of practical application was made. Practical and theoretical aspects on the resolution of these problems were suggested.

Springfield Armory, Mass.
ULTRASONIC STUDIES OF DIE BLOCK MATERIALS, by R. D. Korytoski. 15 June 59, 24p. 7 refs. SA-TR19-1502.
Order from LC mi$2.70, ph$4.80 PB 144 567

Basic studies were conducted using ultrasonic vibration principles in nondestructive evaluation die block material. These studies included (1) ultrasonic reflection investigations, (2) destructive metallurgical examinations of materials ultrasonically tested, (3) evaluation of material performance in forging application. (Author)

Yale U., New Haven, Conn.
ROTATION TESTS IN PLASTICITY, by Aris Phillips and Shan Yuan Yu. Technical rept. no. 3 on Contract Nonr-609(12). Dec 57, 25p. 8 refs. AD-153 838.
Order from LC mi$2.70, ph$4.80 PB 138 079

Ten rotation tests on thin-walled tubes of aluminum alloy 3S-0 show that the assumption of isotropic strain-hardening is only approximately valid in the range of small plastic strains. In these tests plane states of stress α_1, α_2 ($\alpha_1 > \alpha_2$) existing on the outside surface of a thin-walled tube were rotated to various angles (up to 90°) about the radial direction. During the rotation the values α_1 and α_2 remained unchanged. Authors found that the plastic strain components increase during the rotation, but that the directions of the principal axes of plastic strain remain practically constant in most cases.

Yale U., New Haven, Conn.
A THEORY OF IDEAL LOCKING MATERIALS, by Aris Phillips. Technical rept. no. 4 on Contract Nonr-609(12). Feb 58, 20p. 6 refs. AD-153 839.
Order from LC mi$2.40. ph$3.30 PB 138 253

The concept of the ideal locking material, is extended to cover materials which have two different equations of state, one for the change in volume and the other for the change in shape. Possible stress-strain relations are discussed. The concepts of volumetric locking and of distortional locking are introduced, and it is shown by means of an example that there are cases in which these two modes of locking are incompatible over the same region, The problem of locking of a hollow sphere is discussed in detail.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Alco Products, Inc., Schenectady, N. Y.
METHODS FOR CALCULATION OF THERMAL MULTIPLICATION CONSTANT, RESONANCE ESCAPE PROBABILITY AND FAST FISSION FACTOR FOR LOW ENRICHMENT REACTORS, by B. J. Byrne. Rept. on Contract DA 44-009-eng-2868. 25 Jan 57, 42p. 1 ref. APAE memo. no. 82; AD-210 689.
Order from LC mi$3.30, ph$7.80 PB 145 024

This report describes methods used for the calculation of thermal multiplication constant, resonance escape probability, and fast fission factor for a low enrichment reactor. These parameters are used in a modified two-group calculation of the effective multiplication constant. Previously, a homogeneous model has been used for calculation of these parameters. The methods presently being used incorporate the effect of heterogenity into the calculation of thermal multiplication constant and resonance escape probability. The fast fission factor is still calculated on the basis of a homogeneous model, but a new correlation has been chosen which gives a better fit to available experimental data. (Author)

Hebrew U. (Israel).
DETERMINATION OF RELATIVE ABUNDANCE, RATIO OF MAGNETIC MOMENTS, RATIO OF CAPTURE CROSS-SECTIONS OF GADOLINIUM ISOTOPES BY MEANS OF PARAMAGNETIC RESONANCE SPECTRUM, by W. Low and D. Shaltiel (Israel Inst. of Tech.). Technical note no. 5 on Contract AF 61(052)59. Nov 58, 12p. 6 refs. AFOSR TN-59-84; AD-210 144.
Order from LC mi$2.40, ph$3.30 PB 138 711

Naval Radiological Defense Lab., San Francisco, Calif.
IONIZATION RATE AND PHOTON PULSE DECAY OF FISSION PRODUCTS FROM THE SLOW-NEUTRON FISSION OF U^{235}, by C. F. Miller and P. Loeb. 4 Aug 58, 91p. 5 refs. Research and development technical rept. USNRDL-TR-247.
Order from LC mi$5.40, ph$15.30 PB 144 727

Computation giving the theoretical ionization rate and response of the AN/PDR-39(TIB) radiac at 3 feet above an infinite plane uniformly contaminated with fission products from 10^4 fissions of U^{235} per sq. ft. are presented as a function of time after fission. The response of the USNRDL 4-pi ionization chamber and the photon pulse rate for the fission products are also presented as a function of time after fission. Disintegration-rate multipliers for each fission product nuclide per d/s of the nuclide are given; the multipliers were used to obtain the contribution of each fission product nuclide to the gross response. The theoretical ionization rate decay curve was integrated to obtain the gamma dose from the fission product mixture for various periods of time after fission. (Author)

New York U. Coll. of Engineering, N. Y.
A STUDY OF DEAD TIME AND RESOLVING TIME IN A PROPORTIONAL COUNTER, by William Reidy. Rept. on Contract AF 18(600)1555. Jan 59, 58p. 21 refs. AFOSR-TN-59-501; AD-215 926.
Order from LC mi$3.60, ph$9.30 PB 144 492

Measurements were made on a helium isobutane counter, which determined the variation of dead time and resolving time with voltage and pulse amplitude. The purpose of this investigation, was to determine the dead time and resolving time of the counter when operated in the proportional region and contrast this with operation in the geiger region. Results were obtained from photographs and direct measurements of the counter pulse as displayed on an oscilloscope. In addition, measurements were made by the two-source method to determine the resolving time of a proportional counter and its associated electronic counting system.

Elementary Particles

Maryland U., College Park.
AN ATTEMPT AT UNIVERSAL FOUR-FERMION INTERACTION, by J. C. Pati and S. Oneda. Rept. on Contract AF 49(638)24. June 59, 47p. 31 refs. Physics Dept. Technical rept. no. 139; AFOSR-TN-59-630; AD-218 820.
Order from LC mi$3.30, ph$7.80 PB 144 429

An attempt is made to explain the various decays of strange particles on the basis of vector and axial-vector four-fermion interaction. The existence of (V + A) currents as well as (V-A) currents is considered as a possibility and the interaction is assumed to have the form $f(J_a^{(+)} J_a^{(+)} + J_a^{(-)} J_a^{(-)}) + h.c.$, where f is the coupling constant, $J_a^{(-)}$ is composed of all charged currents which have negative chirality, $A\gamma_a(1+\gamma_5)B$, and $J_a^{(+)}$ of those charged currents which have positive chirality, $C\gamma_a(1-\gamma_5)D$. The leptonic currents necessarily belong to the $J_a^{(-)}$ group since the neutrion has a negative helicity. We have studied the appropriate assignment of chiralities to various possible charged baryonic currents in order to explain the characteristics of hyperon decays in the framework of global symmetry for the pion interactions. The virtual pionic or kaonic effects outside the loop are neglected. Results show that there are 3 solutions which can explain reasonably well the branching ratios and asymmetry parameters of hyperon decays. One of the solutions seems to be the best since it explains rather well the rates of hyperon decays and $\pi \rightarrow 1 + \gamma$ decay at the same time. Signs of asymmetry parameters of hyperon decays are important to distinguish these solutions.

Purdue U., Lafayette, Ind.
DECAY OF HYPERONS AND MESONS FROM THE UNIVERSAL FERMI INTERACTION, by Akihiko Fujii and Masaaki Kawaguchi. Rept. on Contract AF 18(600)1579. [1958] 22p. 8 refs. AFOSR-TN-58-921; AD-204 559.
Order from LC mi$2.70, ph$4.80 PB 137 844

The decay of the hyperon, charged pion and kaon except $K_{\pi 3}$ is investigated on the basis of the universal V-A Fermi interaction together with the idea of the Gell-Mann tetrahederon, by treating the virtual baryon-antibaryon pair effect in a phenomenological way. It is shown that the decay rate of $K^+_{\pi 2}$ calculated by the parameters adjusted to the decay of π^+, $K^+_{\mu 3}$, and K^+_{e3} is in agreement with experiment, thus suggesting a possible consistent picture of the model. (Author)

Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh, Pa.
PRECISION SCATTERING OF NUCLEAR PARTICLES. THE NUCLEAR SHELL MODEL, I, by J. B. French. Technical rept. no. 9, Pt. 1, on Contract N7onr-32505. Mar 58, 176p. 70 refs.
Order from LC mi$8.10, ph$27.30 PB 138 573

See also PB 140 099

Uppsala U. (Sweden).
ANTIPROTONS IN NUCLEAR EMULSIONS, by A. G. Ekspong, S. Johansson and B. E. Ronne. Technical rept. on Contract AF 61(514)1015. Phase A. [1957] 27p. 2 refs. AFOSR TR-58-25; AD-152 200.
Order from LC mi$2.70, ph$4.80 PB 138 491

Effort was concentrated on two problems, the properties and behavior in matter of (1) the antiprotons, and (2) the negative K-mesons.

Radioactivity

Air Force Cambridge Research Center, Bedford, Mass.
GLOBAL FALLOUT AND ITS VARIABILITY, by E. A. Martell. Oct 59, 37p. 84 refs. Geophysical Research Papers no. 65; AFCRC-TR-59-268.
Order from OTS $1.00 PB 161 345

Ba^{140}/Sr^{90} activity ratio data for individual rains are discussed to show means of distinguishing between the stratospheric or tropospheric origin of fallout. Sr^{89}/Sr^{90} activity ratio data allow approximate estimation of the fallout contribution from major test series. Evidence for variation in stratospheric storage times, transport paths, and fallout distribution areas is discussed. Estimated residence times are 6 months to 1 year for Soviet tests, 1 to 2 years for debris in the lower equatorial stratosphere, and 5 to 10 years for the CASTLE tests. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
DECONTAMINATION OF FISSION PRODUCTS AND OTHER ATOMIC BOMB DETONATION DEBRIS, by C. F. Miller, R. Cole and others. 24 Nov 53, declassified 29 Jan 59, 46p. 7 refs. USNRDL-439.
Order from LC mi$3.30, ph$7.80 PB 145 026

The decontamination of simulated atomic bomb detonation radioactivity in a synthetic seawater contaminant medium has been investigated. The effects of initial level and time of cleaning on the decontamination of Navy gray paint surfaces using a stirrer and a spray chamber were observed where the data could be best represented by the general equation

$$F = aI^{n-1} + \frac{I}{I+K_2}$$

in which F is the fraction of contamination remaining, I is the initial level, and a, n, and K_2 are functions of the time at which the decontamination is performed. The first term of this equation was associated with sorption phenomena while the second term was derived for a solubility mechanism. The equation was applied to previous data which the authors had obtained using the same contaminant medium on paint surfaces for various decontaminating reagents. (Author)

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Quartermaster Research and Engineering Center, Natick, Mass.
LAUNDERING CHARACTERISTICS OF ENVIRONMENTAL HEADGEAR: ARMY CAP, FIELD, COTTON, OG 107 AND NAVY CAP, INTERMEDIATE, COLD WEATHER, by Jean H. Crosson. Oct 59, 18p. 4 refs. Clothing Branch Series rept. no. 12.
Order from LC mi$2.40, ph$3.30 PB 144 534

The investigation was to compare the laundering characteristics of two similar types of Army and Navy environmental headgear in order to determine the effects of laundering on sizing, fit and appearance. The study showed that both types of caps shrank, excessively in the case of the Navy item, and the appearance of each was poor, with the lowest rating accorded the Army Model. To overcome the laundering and appearance problems, development of new material has been undertaken and caps incorporating the first approach, namely, a Dacron/Rayon fabric in a Gabardine weave, have been procured for User Test.

PHYSICS

Avco Corp., Wilmington, Mass.
RESULTS OF AN APPROXIMATION METHOD TO THE MIE THEORY FOR COLLOIDAL SPHERES, by R. Penndorf. Scientific rept. no. 1 on Research on Aerosol Scattering in the Infrared, Contract AF 19(604)5743. Sep 59, 45p. 11 refs. Technical rept. RAD-TR-59-36; AFCRC-TN-59-608; AD-227 660.
Order from LC mi$3.30, ph$7.80 PB 144 438

An approximation method is outlined for computing the total Mie scattering coefficient K in aerosols using infrared light sources. The method is valid for any size parameter α, from small to very large spheres and any arbitrary real refractive index $n \leq 2$. Analytical expressions are developed for the phase and the amplitude of K at the maxima and minima. The constants in these analytical expressions are determined from existing data computed by the exact Mie theory. Finally, a graphical interpolation process allows for determination of K for any arbitrary size. This method leads to an accuracy of ± 2 or 3 percent for K as compared with results obtained by the Mie theory. This approximation method is then applied to 14 refractive indices n between 1.05 and 2.0. The results for smoothed $\overline{K}$ values are listed for the range $\alpha = 0.2(0.2)\,30(0.5)40$, which is considered sufficient for most applications. For very large spheres, the laws of geometrical optics can be used successfully. Graphical representations of all cases are also included. From these figures, the appropriate $\overline{K}$ value can be read off directly for any given size parameter, and also for any given radius of the aerosol particle, if the wavelength of the incoming infrared radiation is selected.

Maryland U., College Park.
SOLID STATE THEORY. Final rept. on Contract AD 18(600)1015. Oct 58, 8p. 32 refs. AFOSR-TR-58-147; AD-205 094.
Order from LC mi$1.80, ph$1.80 PB 137 932

A listing of technical reports published or in preparation on this contract.

Naval Avionics Facility, Indianapolis, Ind.
TEMPERATURE CONVERSION TABLES, by Wayne A. Brodhecker. Nov 59, 85p. NAFI-TP-99.
Order from OTS $2.25 PB 161 354

The platinum resistance thermometer used as a primary standard in the Standards and Calibration Laboratory at the U. S. Naval Avionics Facility, Indianapolis is calibrated in degrees Celsius (centigrade), and many of the thermometers used at NAFI are in degrees Fahrenheit. There was a need for a method of converting degrees C to degrees F without having to perform the mathematical calculations for each point checked on a thermometer. The tables were calculated on an IBM 650 Computer; using the basic formula ($^oC = 9/5\ ^oF + 30^o$). This formula was used instead of the formula ($^oF = 5/9\ (^oC - 32^o)$) in order to make use of the three-place accuracy obtained in using the resistance thermometer and at the same time to keep the tables small enough to be of practical use. By interpolation three-place accuracy may be obtained in degrees F when going from degrees C to degrees F. Range is -100^oF to 300^oF. Calculation is to 3 decimal places.

Acoustics

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
ACOUSTIC PROPAGATION IN A DIATOMIC GAS SUBJECT TO THERMAL OR CHEMICAL RELAXATION, by Walter E. Gibson and Franklin K. Moore. Rept. on Contract AF 18(603)19. Dec 58, 70p. 14 refs. Rept. no. HF-1056-A-2; AFOSR-TN-58-1057; AD-206 988.
Order from LC mi$3.90, ph$10.80 PB 144 523

A theory of acoustic propagation in a gas subject to relaxation phenomena is presented. In most applications of the thoery to diatomic gases, only one degree of freedom need be considered, all the others being either frozen or in equilibrium. An acoustic equation is obtained herein for small disturbances from an equilibrium state of rest; this equation applies equally well to unsteady one-dimensional waves or to steady two-dimensional disturbances. The problem of two-dimensional airfoil in a supersonic flow of relaxing gas is considered. From the acoustic equation, the law of decay of shock waves and the values of the flow properties on the surface of the airfoil are derived. Furthermore, the asymptotic behavior of the flow field is obtained far from the airfoil so that the formation of an equilibrium wave is described.

Naval Ordnance Lab., White Oak, Md.
NUMERICAL SOLUTION OF THE WAVE EQUATION FOR A POINT SOURCE IN SHALLOW WATER, by B. L. Hord. 23 Sep 57, 30p. 4 refs. NAVORD-5716; AF-157 276.
Order from LC mi$2.70, ph$4.80 PB 144 722

Numerical integrations have been made of the wave equation solution for a point source in shallow water. Difficulties in making evaluations for the case $c_1 < c_2$ were considered but no computations were made for this case. Values were obtained for several source frequencies and two different source-receiver geometries for the case $c_1 > c_2$. The results show a smooth transition between two asymptotic values for the normal incidence configuration. Values for the second configuration were computed for several source frequencies up to 450 cps. Higher frequencies require prohibitive computation times on the IBM 650 computer. (Author).

Naval Research Lab., Washington, D. C.
THE THEORY OF THE THICK-SHELL HOLLOW-PIEZOCERAMIC-SPHERE UNDERWATER SOUND TRANSDUCER, by S. Hanish. Interim rept. 10 Dec 59, 33p. 10 refs. NRL rept. 5405.
Order from LC mi$3.00, ph$6.30 PB 142 854

A thick-shell hollow piezoceramic sphere electroded completely on both inside and outside surfaces and polarized radially can be used as a source (and receiver) of underwater sound. Restricting the theory to moderately thick shells, the text analyzes the acoustic performance of this structure. Derivations are obtained of electromechanical equations of displacement in the radial extensional mode under forced electrical drive, electromechanical coupling, acoustic power, receiving sensitivity, and input electrical admittance. Low-frequency and thin-shell approximations are also formulated, and results are compared with published literature. (Author)

Psycho-Acoustic Lab., Harvard U., Cambridge, Mass.
PERIODIC STATUS REPORT 32. Rept. for 16 May-15 Nov 58 on Contract Nonr-1866(15) and National Science Foundation Grant G-2668. 15 Nov 58, 18p. 69 refs. PNM-80.
Order from LC mi$2.40, ph$3.30 PB 144 685

See also PB 138 819

Willow Run Labs., U. of Michigan, Ann Arbor.
A BIBLIOGRAPHY ON ACOUSTIC SOURCES AND THEIR RELATED FIELDS, by George B. Thurston and Raya Stern. Rept. on Contract Nonr-1224(24). Feb 59, 69p. 347 refs. Rept. no. 2784-2-S.
Order from OTS $1.75 PB 161 330

This report is a bibliography on acoustic sources and their related fields. Both single sources and arrays of sources have been considered. The abstracts are arranged into a detailed subject outline having four major topics: Single Sources and Receivers; Arrays of Sources and Receivers; Transducer Properties; Acoustic Fields. Articles published during the period from 1935 to 1958 are reviewed principally.

Willow Run Labs., U. of Michigan, Ann Arbor.
A BIBLIOGRAPHY ON PROPAGATION OF SOUND THROUGH PLATES, by George B. Thurston and Raya Stern. Rept. on Contract Nonr-1224(24). Feb 59, 170p. 991 refs. Rept. no. 2784-1-S.
Order from OTS $3.00 PB 161 329

This report is a bibliography on propagation of sound through plates. The abstracted material is organized in accordance with a detailed subject outline having five major topics: Transmission Through Plates; Wave Propagation; Properties of Materials; Vibrating Surfaces and Plates; General References. Literature surveyed is principally in the period from 1929 to 1958. Approximately 450 abstracts are given.

Electricity and Magnetism

Atomics International, Canoga Park, Calif.
RESEARCH ON ELECTRON ENERGY STATES IN TRANSITION METALS, by Ted G. Berlincourt, Guy W. Lehman, and R. R. Hake. Final rept. for 1 May-30 June 57 on Contract AF 18(600)1575. 31 July 58, 42p. 35 refs. AI-3051; AFOSR-TR-58-109; AD-201 611.
Order from LC mi$3.30, ph$7.80 PB 137 811

Hall effect, resistivity, and magnetoresistivity of Cu, Zr, Ti, and Nb at temperatures between 1°K and room temperature and in magnetic fields up to 30 kilogauss. Anomalous behavior was observed in the Hall effect of Cu in that size effects were evident for sample thicknesses considerably greater than the generally accepted mean free path. Strong temperature dependences were observed in the Hall coefficients of Cu, Ti, and Zr, the coefficients of Zr and Ti were found to be extremely sensitive to impurity content.

Diamond Ordnance Fuze Labs., Washington, D. C.
DEPENDENCE OF METAL-TO-SEMICONDUCTOR CONTACT RESISTANCE UPON CONTACT LOADING, by Alford L. Ward. 30 July 59, 53p. 14 refs. TR-731.
Order from LC mi$3.60, ph$9.30 PB 144 565

The spreading resistance has been shown to be modified by the injection of minority carriers at the contact. The piezoresistance matrix is used to study the effect of contact stress on the semi-conductor resistivity. The mechanism of a large observed change of contact resistance with loading has been shown to be due to the change of the effective contact area.

Harvard U., Cambridge, Mass.
PARAMAGNETISM IN DIAMAGNETIC MOLECULES, by William Weltner, Jr. Rept. on Contract N5ori-76, T. O. 14. [1957] 29p. 43 refs. AD-153 016.
Order from LC mi$2.70, ph$4.80 PB 138 447

The experimental and theoretical determinations of the Van Vleck paramagnetic contribution to the sus-

ceptibility of diamagnetic molecules are considered. The data on the hydrogen molecule are reviewed, and the mean square orbital angular momentum is recalculated using Newell's wave function.

Philips Labs., Irvington-on-Hudson, N. Y.
RESEARCH INVESTIGATIONS OF MAGNETIC MATERIAL, PERMANENT CERAMIC TYPE, by Frank G. Brockman. Final technical rept. for 1 Aug 54-30 June 55 on Contract DA 36-039-sc-56759. 18 July 55, 26p. 5 refs. Research Lab. Technical rept. no. 93.
Order from LC mi$2.70, ph$4.80 PB 144 521

Producing a ceramic permanent magnet of composition type $M^{II}O\ (Fe_2O_3)_6$ with an energy product, $(BH)_{max}$, exceeding 3×10^6 gauss-oersteds. Studies made to locate and eliminate the causes of non-reproducibility.

Electronics

Air Force Cambridge Research Center, Bedford, Mass.
COMMUNICATION BY PARTICLE BEAMS, by William M. Preston (Harvard U.) and S. Gruber. Sep 59, 24p. AFCRC-TR-59-189; AD-228 528.
Order from LC mi$2.70, ph$4.80 PB 144 418

It is shown that the use of particle beams is impractical for communications, whether the particles are charged or uncharged, and whether evaluation is based on generation, transmission, or detection.

Diamond Ordnance Fuze Labs., Washington, D. C.
A UNIFIED THEORY OF BREAKDOWN AND THE GLOW DISCHARGE, by A. L. Ward and M. J. Reddan. 16 Oct 59, 24p. 10 refs. Technical rept. TR-784.
Order from LC mi$2.70, ph$4.80 PB 144 759

Townsend's basic ionization equations for cold-cathode discharges between parallel plates are modified by Poisson's equation to account for the distortion of the field by space charges. Numerical calculations of voltage vs current-density static characteristics have been carried out on the IBM 704 computer. The regions of validity of earlier breakdown approximations are indicated. The subnormal, normal and abnormal glow regions are shown to develop as the current is progressively increased. Although comparison with experimental data is made difficult by the changing area of discharges, data both from DOFL and from other laboratories indicate the validity of the calculations. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
GENERALIZED ENERGY RELATIONS OF NONLINEAR REACTIVE ELEMENTS, by Chai Yeh. Memo. on Project Michigan, Contract DA 36-039-sc-78801. Sep 59, 8p. 1 ref. 2900-97-R.
Order from LC mi$1.80, ph$1.80 PB 144 502

This memorandum generalizes the theory of energy relations of nonlinear reactive elements from its original form of two applied frequencies by Manley and Rowe to any number of nonharmonically related frequencies. The derivation of equations follows a pattern similar to the one established by Manley and Rowe with the exception that a Fourier summation of r variables is used. (Author)

Molecular Physics and Spectroscopy

Aeronutronic, Newport Beach, Calif.
SPECTRAL EMISSIVITY OF HYDROGEN CHLORIDE FROM 1000-3400 CM^{-1}, by V. Robert Stull and Gilbert N. Plass. Scientific rept. no. 5 on Contract AF 19(604)2166. 15 May 59, 31p. 9 refs. Publication no. U-461; AFCRC-TN-59-467; AD-228 303.
Order from LC mi$3.00, ph$6.30 PB 144 412

The spectral emissivity of hydrogen chloride from 1000 - 3400 cm^{-1} is calculated as a function of temperature, pressure, and amount of radiating gas. The emissivity was calculated with the aid of an electronic computer from the usual expressions for the energy and intensity taking into account up to 2900 spectral lines at 2400°K. The harmonic oscillator approximation was used to evaluate the electric dipole matrix element for the higher vibrational states where no experimental measurements have been made. The emission from HCl^{35}, HCl^{37}, DCl^{35}, and DCl^{37} was included in the calculation. The statistical model and the random Elsasser model were used to calculate the emissivity from the line strengths. The characteristic shift of the emission to lower frequencies as the temperature increases is quantitatively explained. The emission in this frequency region of any flame containing HCl can readily be obtained from the results given here.

Catholic U. of America, Washington, D. C.
A STUDY OF NH RADICAL BY THE LCAO-SCF MOLECULAR ORBITAL METHOD [AND] A MOLECULAR ORBITAL TREATMENT OF SIMPLE OPEN SHELL MOLECULAR SYSTEMS, by Virginia Griffing, Marjorie Boyd and Bernard J. Ransil. Technical rept. no. 4 on Contract Nonr-1220(00). 15 Feb 58, 60p. 66 refs.
Order from LC mi$3.60, ph$9.30 PB 138 340

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech, Pasadena.
SPECTROSCOPIC STUDIES OF HEATED SALTS BEHIND SHOCK FRONTS, by H. Takeyama and V. C. D. Dawson. Technical rept. no. 8 on Contract AF 18(603)2. Nov 58. 27p. 5 refs. AFOSR-TN-58-1079; AD-207 589.
Order from LC mi$2.70, ph$4.80 PB 138 350

The spectra of heated solids behind shock fronts are similar to spark and arc spectra and are strongly dependent upon the shock conditions. Experimental studies of emission intensities as a function of time

indicate that excessive cooling occurs in the shock tube and that population temperatures of electronically excited atoms and positive ions cannot be determined reliably.

Harvard U., Cambridge, Mass.
A NOTE ON THE DETERMINATION OF MOLECULAR STRUCTURE FROM SPECTROGRAPHIC DATA, by Victor W. Laurie. Rept. on Contract N5ori-76, T. O. 14. [1957] 12p. 34 refs. AD-153 017.
Order from LC mi$2.40, ph$3.30 PB 138 446

The problem of the change upon isotopic substitution of "effective" bond lengths and angles involving hydrogen is considered. Evidence is presented that in certain cases such variation is largely due to vibration of the heavy atoms rather than of the hydrogens. A method of calculating this effect is presented which utilizes a parameter similar to the "quantum defect" $\Delta = I_c - I_a - I_b$ observed in planar molecules.

Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.
MICROWAVE SPECTRUM OF $CH_2DCH{:}CH_2$; EQUILIBRIUM CONFORMATION OF PROPYLENE, by Dudley R. Herschbach and Lawrence C. Krisher. Rept. on Contract N5ori-T866, T. O. 14. [1957] 5p. 7 refs.
Order from LC mi$1.80, ph$1.80 PB 138 449

A sample of $CH_2DCH{:}CH_2$ was prepared by reacting allyl chloride with D_2O in the presence of Zn dust and excess Ac_2O. The frequencies were observed and recorded. Two isomers were observed, and the spectra were in excellent agreement with initial predictions. The relation $I_a + I_b - I_c = I(CH_3)$ was satisfied for the species assigned as sym-I which indicated that it had a plane of symmetry containing the D atom.

Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.
MICROWAVE SPECTRUM OF PROPYLENE OXIDE. Rept. on Contract N5ori-1866, T. O. 14 Feb 58, 11p. 1 ref.
Order from LC mi$2.40, ph$3.30 PB 138 450

Massachusetts Inst. of Tech., Cambridge.
SOLID-STATE AND MOLECULAR THEORY GROUP, by J. C. Slater. Quarterly progress rept. no. 31 on Contract Nonr-1841(34). 15 Jan 59, 57p. 20 refs.
Order from LC mi$3.60, ph$9.30 PB 144 229

Contents:
X-Ray and neutron scattering from electrons in a crystalline field and the determination of outer electron configurations in Fe and Ni
Energy bands in iron
Iron series atoms and ions
I. B. M. 704 program for generating the irreducible representations of the group of spin coordinate permutations
Spinor waves in a crystal
Interaction of a hole with mobile lattice ions in KCl
Pseudo Hamiltonians
Electronic wave functions for polyatomic molecules
Auxiliary computer techniques
Programs for evaluation of molecular integrals
Kinetic theory of moderately dense gases
Simulation of river systems by digital computer
Multi-center integral programs for I. B. M. 704 computer
(See also PB 143 224)

Naval Research Lab., U. of Wisconsin, Madison.
THE ANATOMY OF MOLECULAR PHYSICS, by Joseph O. Hirschfelder. Rept. on Contract NOrd-15884. 14 Oct 57, 12p. 1 ref. CM-915; AD-149 478.
Order from LC mi$2.40, ph$3.30 PB 137 942

An effort is made to explain the inter-relations between the fundamental laws of physics, the molecular properties, the bulk properties of materials, and the various types of experimentation. These inter-relations are becoming extremely important as interests widen to encompass extreme conditions of temperature, pressure, etc., and as experimentation becomes more precise.

Ohio State U. Research Foundation, Columbus.
FURTHER DEVELOPMENTS IN THE THEORY AND USE OF THE ELECTRON SPECTROMETER, by Edwin N. Lassettre, Sam Silverman, and Marvin E. Krasnow. Scientific rept. no. 11 on Contract AF 19(122)642. July 57, 24p. 3 refs. AFCRC-TN-58-235; AD-220 107.
Order from LC mi$2.70, ph$4.80 PB 139 429

The equations used for the determination of electronic collision cross sections by means of an electron spectrometer have been described and discussed in a previous report. The construction and performance of a spectrometer suitable for this purpose has also been described. Since the preparation of these reports several of the factors which affect the accuracy of the measured cross sections have been examined in greater detail from both an experimental and theoretical viewpoint. Those factors which will be treated in detail in this report are the pressure dependence of the scattering, the determination of cross sections by the study of the scattering due to a mixture of the gas under consideration and the calibrating gas, and, finally, a study of the effect of incident beam divergence on the accuracy of the measured cross sections. The discussion of these matters will serve to confirm the validity of the procedures heretofore used and will indicate some ways in which the technique may be further improved. This report supplements Scientific Report No. 2 of this series.

Syracuse U. Research Inst., N. Y.
THE DIPOLE MOMENT FUNCTION OF DIATOMIC MOLECULES. by John Trischka and Harold Salwen (Harvard U.) Technical rept. on Contract Nonr-669(09). 1 Jan 59, 30p. 6 refs.
Order from LC mi$2.70, ph$4.80 PB 144 458

The connection between the dipole moment function and its matrix elements has been studied for the one-dimensional model of a diatomic molecule.

[Syracuse U., N. Y.]
MOLECULAR BEAM RADIOFREQUENCY SPECTRA OF MOLECULES, by J. W. Trischka. Final rept. on Contract N6onr-248, T. O. 11. Nov 57, 6p. 12 refs. AD-147 105.
Order from LC mi$1.80, ph$1.80 PB 137 886

The main object was to study the radiofrequency spectra of the alkali halides by the molecular beam electric resonance method. Studies were made of phenomena which contributed to the use of the molecular beam method, to develop theories important to the interpretations of the results and to design specialized pieces of apparatus which contributed to the advance of the art.

Optics

Air Force Cambridge Research Center, Bedford, Mass.
ATMOSPHERIC REFRACTION OF INFRARED RADIATION, by Thomas P. Condron. Oct 59, 20p. 5 refs. GRD Research Notes no. 23; AFCRC-TN-59-617.
Order from OTS $0.50 PB 161 342

This note contains preliminary calculations of approximate infrared irradiance values in the neighborhood of caustic surfaces; these caustics are predicated from ray calculations based on the ARDC Model Atmosphere. The caustics which should occur at 1500 km skip-distances are caused by the downward refraction of a small bundle of rays emitted from a source at nearly horizontal inclination to the earth's surface at various altitudes. The predicted increases in irradiance in these annular caustic regions indicates that the phenomenon may be useful for long-range missile detection. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
THE "CLAM SHELL" THERMAL IMAGE DEVICE (THERMAL IMAGER) by George P. Ploetz. Sep 59, 9p. AFCRC-TN-59-759.
Order from LC mi$1.80, ph$1.80 PB 144 587

A novel thermal imaging device is described. Two identical reflecting paraboloids are mounted face to face so that the focal point of each falls at the vertex of the other. This arrangement allows both the source and image to be external to the optical system. The benefits of the device include: improved images, higher temperatures, and increased power transfer. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
STUDY OF A PHOSPHOR LIGHT PULSER, by Michael R. Zatzick. Sep 59, 26p. 10 refs. Instrumentation for Geophysics and Astrophysics no. 10; AFCRC-TR-58-274.
Order from OTS $0.75 PB 161 343

A short persistence 5RP-15A cathode-ray tube and a simple optical system (lens, ultraviolet pass filter, and adjustable slit) were used with moderate success to produce variable "square wave" light pulses of predictable rise time and duration. Absence of the expected near ultraviolet emission peak of the P-15 limited observable pulse durations to ~7 μsec instead of an expected ~0.1 μsec since preliminary RCA data did not mention that only one out of fifty P-15 coatings emit the near ultraviolet peak. Rise times of ~0.1 μsec were possible, but the transient response of the photometer for increasing light levels, ~300 v/μsec, permitted observation of only 2.5 μsec rise times (10 to 90 percent). When neither the phosphor nor photometer limitations entered, the measured pulse shape was reproducible within the 5-percent expected error. Improvements in the design of the light pulser are suggested for attaining faster light pulses. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
THE BEHAVIOR OF A LIGHT RAY PENETRATING A SUPERSONIC FLOW FIELD, by Harald A. Melkus. Oct 59, 58p. 6 refs. AFMDC-TR-59-39.
Order from LC mi$2.60, ph$9.30 PB 144 594

Data on deflections of a light ray penetrating a supersonic flow field have been requested by the Guidance and Control Division, Directorate of Advanced Technology, Holloman Air Force Base. The data are important for estimates of aerodynamically induced errors in schemes for measuring angular positions of a guidance platform during motion on a sled at supersonic speeds. (Author)

Anderson Physical Lab. [Champaign, Ill.]
THE DETERMINATION OF NEAR INFRARED SPECTRA, by Scott Anderson, Raymond Isaac, and Myra Blankenship. Rept. for 1 May 58-30 Apr 59 on The Determination of Near Infrared Spectra, Contract AF 33(616)5283. Sep 59, 32p. 22 refs. WADC Technical rept. 59-344.
Order from OTS $1.00 PB 161 336

Near infrared spectra of organic compounds of interest to the Air Force Research and Development Program, were determined between the region 0.7 to 3.2μ on a Beckman DK-2 Ratio Recording Spectrophotometer. Modification of the instrument's recording, to accommodate a chart which presents spectra at a single scale expansion of 2x, is discussed. Rapid sorting of spectra was provided with the use of Wyandotte-ASTM structure and name-formula IBM cards. (Author)
(See also PB 151 309)

Bausch and Lomb Optical Co., Rochester, N. Y.
INFRARED FILM STUDIES, by L. Hurtle. Quarterly technical rept. no. 3, 23 Oct 56-23 Jan 57, on Contract DA 44-009-eng-2876. 8 Mar 57, 13p. AD-202 426.
Order from LC mi$2.40, ph$3.30 PB 144 645

A stable, stress-free, unsupported foil or film is obtained by controlling the thickness of each individual layer of InS and MgF_2. Two new methods of controlling this film thickness were tried. In the first method, the film was continuously deposited on a Ta ribbon and the change in color was observed as a function of time. The filament of Ta could then be purged by passing a current through it and made ready for a second measurement. In the second method a section of a previously made unsupported foil or a very thin mica flake was mounted along the edge of the rotating sample. Films condensing on this foil or flake would cause it to bend either under compression or tension. Hence the rate of deposition of each material could be suitably adjusted to produce a stress-free foil.

Cruft Lab., Harvard U., Cambridge, Mass.
THE ELECTROMAGNETIC THEORY OF LIGHT. I, by Tai Tsun Wu. Scientific rept. no. 9 on Contract AF 19(604)786. 5 Apr 57, 20p. 11 refs. AFCRC TN-57-371; AD-117 073.
Order from LC mi$2.40, ph$3.30 PB 138 777

A theoretical study. Previous theories on diffraction phenomena do not appear to be deducible from Maxwell field equations. An attempt is made to remedy this.

Diamond Ordnance Fuze Labs., Washington, D. C.
A NEAR INFRARED PHOTOMETER, by Louis Melamed. 20 Nov 59, 11p. Technical rept. TR-759.
Order from LC mi$2.40, ph$3.30 PB 144 755

An infrared photometer using a lead sulfide detector was designed specifically to monitor the day-to-day variation in intensity of ambient sky light in the 0.8 to 2.8 μ region. A sensitivity of 3930 μv (μw/cm^2) has been achieved using very simple circuitry and readily available components. (Author)

Upper Air Lab., U. of Colorado, Boulder.
MULTILAYER INTERFERENCE FILTERS FOR INFRARED, by Vern N. Smiley. Scientific rept. no. 3 on Contract AF 19(604)1899. Oct 59, 169p. 26 refs. AFCRC-TN-59-601; AD-228 287.
Order from LC mi$7.80, ph$25.80 PB 144 434

The basic theory of interference filters is discussed starting with the simple Fabry-Perot filter. Methods of calculating the transmittance and reflectance of a multilayer stack are discussed with emphasis on an analog computer method. A derivation of a nearly exact expression of the bandwidth and an expression for the fraction of power transmitted between half-maximum points for an all-dielectric Fabry-Perot filter are given. Band-pass filters of a type containing more than one multiple half-wave layer are examined in detail by calculated curves for several different configurations; they are shown to be superior to the Fabry-Perot dielectric filters. A five-layer dielectric Fabry-Perot filter designed for use as a low-pass filter is treated in detail. A method of analysis consisting of replacing any multilayer system by one layer with two effective interfaces is used to explain the operation of band-pass and low-pass filters. Methods of making experimental filters are discussed, including the experimental difficulties involved. An example of a five layer experimental filter is given.

Solid State Physics

Brown U. Div. of Applied Mathematics, Providence, R. I.
ROTATING DISKS: INSENSITIVITY OF DESIGN, by Jacques Heyman. Technical rept. no. 29 on Contract Nonr-562(10). Dec 57, 19p. 3 refs. C11-29; AD-154 469.
Order from LC mi$2.40, ph$3.30 PB 138 078

The plastic method of design of rotating disks leads to profiles very similar to those generated by conventional elastic methods. The minimum weight disk is investigated and it is shown that a practical disk approximates very closely in its leading dimensions to the minimum weight disk. In particular, the axial length of a disk at its bore is insensitive to the precise form of profile, which makes an elastic trail and error method workable. This insensitivity is examined by using a plastic analysis.

Fulmer Research Inst., Ltd. (Gt. Brit.).
THE SPACING OF SLIP LINES IN METALS, by J. T. Barnby, J. S. Steel and E. A. Calnan. Annual technical rept. no. 2, Apr 58-Apr 59, on Contract DA 91-508-EUC-175. Apr 59, 39p. 15 refs. Research rept. R. 113/5; AD-220 168.
Order from LC mi$3.00, ph$6.30 PB 143 118

An electron microscopic study of the spacing of slip lines in polycrystalline O. F. H. C. copper and high purity brasses containing 5, 15, 30 and 37 per cent zinc is described. Copper specimens showed well defined peaks in the distribution diagrams for slip line spacing, at about 300A. The change in slip-line spacing with zinc content is discussed in terms of current theories of solid solution hardening. Experiments have been directed at producing thin films of copper and brass for transmission electron microscopy, and studying in these specimens the effects of quenched-in vacancies.

Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.
HIGH PRESSURE EFFECTS IN SEMICONDUCTORS; INTERBAND SCATTERING IN GERMANIUM, by Marshall I. Nathan. Technical rept. HP-1 on Contract Nonr-1866(10). 1 Feb 58, 116p. 63 refs.
Order from LC mi$6.00, ph$18.30 PB 138 445

There are minima in the conduction bands of germanium and silicon along the (111) and the (100) directions in k-space. The (111) minima at an energy E_g are the lowest minima in the conduction band of germanium; while the (100) minima at an energy E_s are lowest in silicon. Results of the measurement of the pressure variation of the electrical conductivity of n-type germanium at several temperatures between 0°C and 82°C to 18,000 kg/cm^2 and at 76°C to 30,000 kg/cm^2 are presented. The interband scattering theory is extended to predict the pressure behavior of the galvanomagnetic effects in n-type germanium. (See also PB 140 386)

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
DISLOCATION STRUCTURES OBSERVED IN HIGH-PURITY RECRYSTALLIZED ALUMINUM BY X-RAY DIFFRACTION, by A. R. Lang and G. Meyrick (U. of Bristol). Technical rept. no. 1 on Contract Nonr-1866(39). 17 Feb 59, 7p. 4 refs.
Order from LC mi$1.80, ph$1.80 PB 144 578

Honeywell Research Center, Hopkins, Minn.
THE RELATIONSHIP BETWEEN PLASTIC FLOW AND THE FRACTURE MECHANISM IN MAGNESIUM OXIDE SINGLE CRYSTALS, by T. L. Johnston, R. J. Stokes and C. H. Li. Technical rept. no. 4 on Contract Nonr-2456(00). Feb 59, 34p. 8 refs. HR-59-419.
Order from LC mi$3.00, ph$6.30 PB 144 579

Magnesium oxide crystals plastically deformed under a three point load develop internal slits coplanar with the (110) slip plane and parallel to the [001] bending axis in the tension region. If microcracks form in the early stages of plastic flow their growth is unrestricted and the material is brittle. If the crystal is first plastically deformed to introduce sufficient slip the growth of the microcracks is impeded in certain directions and they develop into narrow slits. For brittle specimens fracture starts from a point, whereas for ductile specimens the fracture appears to start from one of the narrow slits.

Illinois U., Urbana.
HALL EFFECT FOR ELECTRONS IN SILVER CHLORIDE, by Koichi Kobayashi and Frederick C. Brown. Rept. on Contract AF 18(600)662. Aug 58, 27p. 21 refs. AFOSR-TN-57-743; AD-201 509.
Order from LC mi$2.70, ph$4.80 PB 137 540

The drift mobility of electrons in single crystal silver chloride has been investigated over a wide temperature range by means of transit time techniques. Results of these measurements are in reasonable agreement with the theory of electron mobility in polar crystals down to about 80°K but show a wide discrepancy at lower temperatures. The present experiments were carried out to determine whether this effect is due to scattering by imperfections or to multiple trapping effects, and to extend mobility data into the very low temperature range.

Illinois U., Urbana.
A METHOD FOR MEASURING MAGNETIC FIELDS IN SUPERCONDUCTORS, by H. R. Lewis, J. F. Cochran and others. Rept. on Contract AF 18(603)49. Nov 59, 18p. 12 refs. AFOSR-TN-59-1154.
Order from LC mi$2.40, ph$3.30 PB 144 568

In order to measure the magnetic field in a superconductor, a suitable radioisotope is embedded at the desired depth. The rotation of the angular correlation pattern is then used to determine the magnetic field at the nuclear site.

Institute of Optics, U. of Rochester, N. Y.
THE FUNDAMENTAL ABSORPTION EDGE IN CADMIUM SULFIDE, by David Dutton. Technical rept. 14 on Contract AF 18(600)193. June 58, 33p. 32 refs. AFOSR-TN-58-545; AD-158 362.
Order from LC mi$3.00, ph$6.30 PB 137 715

The absorption and reflection spectra of CdS have been determined in the temperature range 90° - 340°K by photoelectric measurements on single crystals, using polarized light.

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
SOME PROPERTIES OF QUENCHED MAGNESIUM FERRITES [AND] TEMPERATURE-DEPENDENT LAG IN POLYCRYSTALLINE YTTRIUM-IRON GARNET, by J. D. Epstein and B. Frackiewicz. Rept. on Contracts Nonr-1841(10) and AF 30(635)2872. Jan 59, 22p. 17 refs. Technical repts. 134 and 135.
Order from LC mi$2.70, ph$4.80 PB 144 482

Magnetic properties of magnesium ferrites where the fraction of magnesium ions in tetrahedral sites, varies from 0.14 to 0.26. Properties examined are: saturation moment, Curie point, initial permeability and coercive force. Samples quenched from 1100°C and then tempered at 600° require somewhat less than 16 h. to attain an equilibrium cation distribution at the latter temperature. Certain samples of polycrystalline yttrium-iron garnet are characterized by a room-temperature permeability spectrum having two regions of dispersion, one at microwave, the other at radio frequency. The former dispersion is identified as gyromagnetic in origin. The radio-frequency dispersion, which exhibits a temperature-activated shift to lower frequency with decreasing temperature, appears due to an electron-diffusion controlled domain-wall relaxation. The activation energy for the process is 0.38 ev.

Naval Ordnance Lab., Corona, Calif.
THE EFFECT OF LINEAR LOADING CAPACITANCES UPON THE SWITCHING TRANSIENT OF COLEMANITE, by David J. White. 12 Sep 58, 36p. 1 ref. NOLC rept. 314; NAVORD rept. 5922; AD-138 640.
Order from LC mi$3.00, ph$6.30 PB 138 640

The polarization-reversal, transient of ferroelectric colemanite shows a discrepancy on the order of 20% from the empirically developed relations for

$BaTiO_3$. The source of the discrepancies in the experimental switching transient of ferroelectric colemanite must be sought in the nature of the ferroelectric colemanite itself.

Naval Ordnance Lab., White Oak, Md.
SOLID STATE DIVISION ANNUAL REPORT FOR 1957, ed. by Robert Talley. 1 July 58, 47p. 61 refs. NAVORD rept. 6193.
Order from LC mi$3.30, ph$7.80 PB 145 027

Most of the work was performed in the field of magnetism with emphasis on antiferrimagnetism and magnetic resonance; and on semiconductors, primarily photo-effects and bulk properties of PbS, PbSe, PbTe, and InAs. (Author)

Naval Ordnance Test Station, China Lake, Calif.
A KINETIC STUDY OF OXYGEN CHEMISORPTION ON PbS LAYERS, by K. Laws and V. R. Honnold. 19 June 58, 20p. 6 refs. NOTS-1623; NAVORD rept. 5378; AD-200 917.
Order from LC mi$2.40, ph$3.30 PB 144 876

Experiments were conducted to study the kinetics of oxygen chemisorption on evaporated layers of PbS. In general the rate of chemisorption, as determined by measuring the resistance of the layers, increased with increasing temperature and oxygen pressure. The data indicates that O^- ions are being formed predominantly in the ranges of temperature and pressures utilized for the experiments. The relationship of the results obtained to the problem of oxygen photosensitization of PbS is discussed. (Author)

Paris U. (France).
STUDIES OF DISLOCATIONS IN METALS BY X-RAY METHODS, by André Guinier. Annual summary rept. no. 1, 1 Jan 58-1 Jan 59, on Contract AF 61(052)51. [1959] 10p. 13 refs. AFOSR-TN-59-348; AD-213 668.
Order from LC mi$1.80, ph$1.80 PB 144 519

The atomic structure of a dislocation was studied by means of diffuse X-ray scattering. Suitable specimens were obtained with single Cu crystals so that only one system of slip lines would be visible. Theoretical calculations showed that scattering is concentrated in the immediate vicinity of the normal nodes of the reciprocal lattice. The scattering due to the thermal agitation is also maximum around the nodes, and its intensity is larger than the expected scattering from the dislocations even at low temperatures. Localization of the imperfections or dislocations in a crystal was investigated by X-ray techniques. Two extreme theoretical cases which were studied are the perfect crystal with dynamical theory and the mosaic crystal with the cinematical theory. The predicted reflecting power is much smaller for the perfect crystal.

Pittsburgh U., Pa.
THE CLOCK PARADOX AND THE PHYSICS OF DISCONTINUOUS GRAVITATIONAL FIELDS, by T. M. Donahue and C. B. Leffert. Technical rept. no. 1 on Contract Nonr-624(06). Oct 57, 28p. 8 refs. AD-146 664.
Order from LC mi$2.70, ph$4.80 PB 137 547

The motion of the clocks as represented in a solution of the clock paradox offered by C. Moller (The Theory of Relativity, p. 258, Oxford University Press, London, 1952) is studied in detail. It is found that in the non-inertial rest frame of the accelerated clock the free clock suffers discontinuities in velocity whenever the "gravitational field" in that frame abruptly changes. Although these discontinuities occur at points of discontinuity of the metric tensor, examination of a case in which the gravitational field is turned on smoothly reveals that the effect is a real one within the framework of the general theory of relativity. By the principle of equivalence it follows that even in a real gravitational field when that field changes in time velocity dependent terms in the acceleration of a particle exist. These become impulsive for abruptly changing fields and can even cause an acceleration in the direction "opposite" to the field.

Rice Inst., Houston, Tex.
THE EFFECT OF VIBRATIONS ON ORDERING IN A COPPER-GOLD ALLOY, by H. C. Burghard, Jr. and Franz R. Brotzen. Technical rept. no. 2 on Contract AF 49(638)78. 1 Oct 58, 31p. 19 refs. AFOSR-TN-58-915; AD-204 564.
Order from LC mi$3.00, ph$6.30 PB 137 846

Experiments were performed to determine the effects of mechanical vibrations on ordering in CuAu. The effects of 5, 10 and 15 kc vibrations were investigated over a range of ordering temperatures of 280 to 360°C. A decrease in the rate of ordering was observed at all frequencies and ordering temperatures. This retarding effect is attributed to the interference of moving dislocations with growth of ordered domains. (Author)

Stockholm U. (Sweden).
STUDIES ON THE CRYSTAL CHEMISTRY OF TITANIUM, VANADIUM AND MOLYBDENUM OXIDES AT ELEVATED TEMPERATURES, by Arne Magnéli, Sten Andersson and others. Final technical rept. no. 1 for 1 Oct 58-30 Sep 59 on Contract DA 91-591-EUC-935. Oct 59, 142p. 15 refs.
Order from LC mi$7.20, ph$22.80 PB 144 408

The work reported in this document has been performed in continuation of X-ray studies previously conducted by members of this research group on the crystal chemistry at elevated temperatures of titanium, vanadium and molybdenum oxides. The atomic arrangement of the ordered phase Ti_3O occurring within the solubility range of oxygen in α-titanium, has been determined. A study has been made of structural and geometrical relations between the δ-titanium oxide and several other phases. An analysis has been performed of the phase relations of the vanadium-oxygen system within the $VO_{0.25}$-$VO_{1.5}$ region at 800°C. Accurate atomic coordinates have been determined for Ti_2O_3 and V_2O_3 at room temperature and for Ti_2O_3 at ∿260°C. The crystal structure of the high-temperature modification of Ti_3O_5 has been determined from single-crystal data regis-

tered at 175°C. The crystal structure of V_3O_5 has been refined to a considerable degree of accuracy. General expressions have been derived for structural properties of the homologous series M_nO_{2n-1} (M=Ti, V or (Ti and Cr)). The phase relations of the MoO_2-MoO_3 region of the molybdenum-oxygen system have been investigated within the temperature range 500° -870°C.

Technisch Documentatie Centrum voor de Krijgsmacht (Netherlands).
BIBLIOGRAPHY ON PHOTOELASTICITY. SUPPLEMENT I, by B. Dijkshoorn. Aug 58, 56p. 233 refs. TDCK-14396; AD-202 162.
Order from LC mi$3.60, ph$9.30 PB 144 826

Items have been arranged in sections according to year of publication, commencing with 1957, and alphabetically by author name within each section. In some cases only the first author is given. Author and subject indexes are included at the back.

Theoretical Physics

Avco [Everett] Research Lab. [Mass.]
IONIZATION PHENOMENON OF SHOCK WAVES IN OXYGEN-NITROGEN MIXTURES, by S. C. Lin. Rept. on Contract AF 04(645)18. June 58, 25p. 15 refs. Research rept. 33; AD-201 912.
Order from LC mi$2.70, ph$4.80 PB 144 736

An experimental method is described for the study of ionization phenomenon associated with shock waves in gases. By proper choice of experimental conditions, this method should allow a direct and unambiguous determination of the electron density and the averaged electron-molecule (and atom) interaction cross section as a function of distance behind the shock front. Preliminary results obtained for shock waves in a number of oxygen-nitrogen mixtures are presented.

California U., Berkeley.
ELIMINATION OF GHOSTS IN PROPAGATORS, by P. J. Redmond. Rept. on Contract DA 04-200-ORD-171, T.O. 11. 21 July 58, 16p. 18 refs. OOR rept. 1353.14P; AD-220 865.
Order from LC mi$2.40, ph$3.30 PB 137 909

Within the general framework of perturbation theory a method for calculating modified propagators in terms of proper Feynman diagrams is derived. This method differs from previous approaches in that one insists that the propagator have the correct analytical behavior as a function of p^2. As a result one gets an expression for the propagator which is similar to a conventional term by term perturbation theory expansion except that it is only necessary to consider proper diagrams and that the iteration of the proper diagrams is represented by a damping factor.

Cornell U., Ithaca, N. Y.
ULTRA-SMALL-ANGLE X-RAY SCATTERING, by L. G. Parratt, J. O. Porteus and others. Technical rept. no. 2 on Contract AF 49(638)402. 20 Dec 58, 16p. 18 refs. AFOSR-TN-58-781; AD-202 002.
Order from LC mi$2.40, ph$3.30 PB 137 936

A new double two-crystal spectrometer is proposed. It is believed that with this instrument, with a high-energy synchrotron as an x-ray source, with either perfect crystals on the spectrometer for the ultra-small angles or with deliberately imperfect crystals for the conventional angular range, and with the newly developed unfolding procedures to correct for the residual instrumental effects, the techniques of small-angle scattering would be advanced to new levels of usefulness in many problems of structural analysis.

Fairchild Engine Div., Deer Park, N. Y.
SOME PROPERTIES OF A HYDROGEN PLASMA, by Charles L. Eisen and Robert A. Gross. Rept. on Contract AF 49(638)15. June 59, 41p. 9 refs. AFOSR-TN-59-588; AD-216 770.
Order from LC mi$3.30, ph$7.80 PB 144 449

The chemical equilibrium composition of a hydrogen mixture is determined over the temperature range from 10^3 °K to 10^6 °K and pressures from 10^{-6} to 10^6 atmospheres. The species recognized are, H_2, H, H^+, H^- and e^-. Equilibrium and frozen values of γ, C_p and the speed of sound are presented in the dissociation and ionization regimes. Electrical conductivity and bremsstrahlung power radiation data are also given.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
THE WAVE MOTIONS OF SMALL AMPLITUDE IN A FULLY IONIZED PLASMA. PART I. WITHOUT EXTERNAL MAGNETIC FIELD, by S. I. Pai. Rept. on Contract AF 49(638)401. Nov 59, 27p. 12 refs. Technical note BN-191; AFOSR-TN-59-1271.
Order from LC mi$2.70, ph$4.80 PB 144 778

Wave motions of infinitesimal amplitude in a fully ionized plasma, consisting of singly charged ions and electrons, have been investigated. A two-fluid theory has been used in this paper. There are no externally applied electromagnetic fields. (See also PB 143 387)

Institute of Field Physics, U. of North Carolina, Chapel Hill.
COVARIANT COMMUTATORS FOR THE QUANTIZED GRAVITATIONAL FIELD, by Bryce S. DeWitt. Rept. on Contract AF 49(638)563. Oct 59, 8p. 3 refs. Publication no. 4; AFOSR-TN-59-1080; AD-226 875.
Order from LC mi$1.80, ph$1.80 PB 144 487

The derivation of covariant commutators for the quantized gravitational field provides an important application of the theory of bi-tensor Green's functions. Because of the coordinate invariance of general relativity, well defined commutators can be obtained only if we (1) introduce some form of invariant coordinates, and (2) succeed in finding an explicit expression which can be used to define an arbitrary external source. These two requirements are related.

Johns Hopkins U., Baltimore, Md.
PLASMA DYNAMICS, by Francis H. Clauser. Final rept. on Contract AF 18(600)671. Aug 59, 79p. AFOSR-TR-59-125; AD-227 708.
Order from LC mi$4.50, ph$12.30 PB 144 732

It is found that in the flow of a gas consisting of charged particles such as electrons, the non-linearity of the equations introduces several new concepts to the lore of fluid mechanics. The behavior of such a gas is investigated without recourse to linearization for the full range of Mach numbers. It is found that the gas can behave in several different ways for t' e same set of boundary conditions. (Author)

Plasma Propulsion Lab., Republic Aviation Corp., Farmingdale, N. Y.
OPTIMUM POWER GENERATION FROM A MOVING PLASMA, by Joseph L. Neuringer. Rept. on Contract AF 49(638)552. Apr 59, 25p. 5 refs. SRS(PPL) rept. 105; AFOSR-TN-59-515; AD-216 280.
Order from LC mi$2.70, ph$4.80 PB 144 491

Plasma Propulsion Lab., Republic Aviation Corp., Farmingdale, N. Y.
OPTIMUM POWER GENERATION USING A PLASMA AS THE WORKING FLUID, by J. L. Neuringer. Rept. on Contract AF 49(638)552. May 59, 52p. 4 refs. SRS(PPL) rept. 114; AFOSR-TN-59-571; AD-217 005.
Order from LC mi$3.60, ph$9.30 PB 144 490

With the possibility of controlled thermonuclear fusion in the future, the question arises whether it would be possible to use the plasma itself as the working fluid to generate electric power by electro-magnetic induction. The problem considered here is the steady one-dimensional motion of a plasma in a channel of arbitrary and slowly varying cross section. (See also PB 144 491)

Syracuse U., N. Y.
CONSERVATION LAWS IN NON-LINEAR FIELD THEORIES, by Robert Penfield and Henry Zatzkis. Technical rept. no. 4 on Contract N6onr-248(06). Jan 50, 12p. 6 refs. AD-201 065.
Order from LC mi$2.40, ph$3.30 PB 137 922

In this paper we have applied the concepts of "strong" and "weak" conservation laws in non-linear field theories as set forth in recent papers. Only if the strong conservation laws are available in a theory, can we treat situations in which matter is present in discrete regions of space without possessing detailed knowledge of the internal structural laws of the matter itself.

Thermodynamics

Brown U. Div. of Engineering, Providence, R. I.
ON TRANSIENT THERMAL STRESS IN LINEAR VISCOELASTICITY, by Eli Sternberg. Technical rept. no. 3 on Contract Nonr-562(20). Nov 57, 31p. 21 refs. 562(20)/3; AD-149 766.
Order from LC mi$3.00, ph$6.30 PB 137 531

The principle of correspondence appropriate to the linear theories of elasticity and viscoelasticity is extended to account for the presence of a time-dependent temperature field, and is applied to the quasi-static determination of transient thermal stresses in a general, linear, homogeneous and isotropic, infinite viscoelastic medium with a spherical cavity. It is assumed that the body is free from loading and that the stress-inducing temperature distribution has polar symmetry about the center of the cavity. An exact solution to this problem is established in integral form on the assumption that all physical parameters are independent of the temperature. Closed explicit solutions, in terms of error functions, are deduced for the special instance in which the material is either a Maxwell or a Kelvin solid, if the temperature field obeys the heat-conduction equation and is generated by a suddenly applied, steadily maintained, heating (or cooling) of the boundary. (Author)

Michigan U., Ann Arbor.
ON THE STRUCTURE OF DETONATION WAVES, by T. C. Adamson, Jr. Rept. on Contract Nonr-1858(25). Apr 58. 20p. 5 refs. Proj. Squid Technical rept. MICH-4-M.
Order from LC mi$2.40, ph$3.30 PB 138 608

National Bureau of Standards, Washington, D. C.
TABLES OF THERMODYNAMIC PROPERTIES OF AIR INCLUDING DISSOCIATION AND IONIZATION FROM 1500°K TO 15,000°K, by Joseph Hilsenrath, Max Klein and Harold W. Woolley. Rept. on ARO, Inc., Contract AF 40(600)800. Dec 59, 147p. 21 refs. AEDC-TR-59-20 MIPR-AEDC-2; OSS 59-24.
Order from OTS $2.75 PB 161 311

Tables are presented, at close spacing in density ($\Delta \log \rho/\rho_0 = 0.2$ from -7. to +2.), of the thermodynamic properties of air from 1,500°K to 15,000°K. The properties tabulated are: the number of moles, $Z^* = PV/RT$, the dimensionless functions for internal energy, E^*/RT, enthalpy, H^*/RT, entropy, S^*/R, and the pressure, P, in atmospheres. Here the asterisk indicates that the properties are for the equilibrium mixture treated as an ideal gas (without so-called van der Waals effects). The underlying equations for this work and the input data are discussed briefly. A comparison is made between the reported values and the work of Gilmore, of the Rand Corporation, and of Predvoditelev and associates, of the U. S. S. R. (Author)

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge, Mass.
AN INVESTIGATION OF POROUS WALL COOLING, by Richard P. Bernicker. Rept. on Contract AF 49(638)245. June 59, 59p. 10 refs. Technical rept. 393; AFOSR-TN-59-873; AD-227 555.
Order from LC mi$3.60, ph$9.30 PB 144 473

Equations are developed to describe the thermal exchange when a coolant is forced through a heated porous wall, and solutions are obtained on the basis of a simplified model consisting of identical cylindrical

channels replacing the actual capillary-like passages. The solutions depend upon Reynolds and Prandtl numbers, geometric parameters involving wall porosity and pore size, and Nusselt number. Experiments were performed with one family of porous materials, and Nausselt numbers were correlated in terms of Reynolds and Prandtl numbers, and porosity. Nusselt number varies almost linearly with Peclet number. Temperature distributions obtained indicate a very small difference between solid and coolant temperatures at the exit surface.

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
SUBLIMATION OF A HEMISPHERE IN SUPERSONIC FLOW, by Robert Weiss. Rept. on Contract AF 49(638)245. July 59, 63p. 38 refs. Technical rept. 391; AFOSR-TN-59-870; AD-227 553
Order from LC mi$3.90, ph$10.80 PB 144 496

Mass transfer cooling with a light gas has been shown to reduce the large heat transfer rates to a body that is moving rapidly through the atmosphere. The possibility of using a subliming body so as to provide self governing mass transfer cooling has been suggested. To make a preliminary evaluation of this approach, an investigation of the heat transfer rates to several subliming bodies of hemispherical shape has been carried out. Tests were run at a Mach number of 3.5 with solid carbon-dioxide, naphthalene and camphor, three relatively "heavy" materials. Additional tests with camphor models determined the effect of Reynolds number on the heat transfer rate. It was found that heat transfer was reduced in proportion to the mass-injection rate, and that a greater reduction was effected with a lesser weight material; and that increasing Reynolds number also produced a lower level of heat transfer coefficient. The bodies tended to assume a conical shape, a phenomenon more noticeable with increasing Reynolds number; only one model appeared to have reached a state of equilibrium. The investigation indicated both the feasibility of conducting an experiment of this nature and the applicability of subliming bodies both in reducing and absorbing aerodynamic heating.

Plasmadyne Corp., Santa Ana, Calif.
FLEXURE OF A TWO-DIMENSIONAL ARC UNDER FORCED CONVECTION, by Paul G. Thiene. Rept. on Contract AF 49(638)334. 25 Aug 59, 74p. 4 refs. T 2TN089-334; AFOSR-TN-59-947; AD-228 540
Order from LC mi$4.50, ph$12.30 PB 144 488

A rudimentary inquiry is conducted into the nature of the physical mechanisms which maintain an arc in the presence of forced convection. The basic fluid-mechanical and electromagnetic equations are developed for the case of a dilute, three-component quasineutral arc plasma. The basic equations, in particular the equation of energy balance, are then applied to a simple model of a two-dimensional arc in a low-Mach-number subsonic flow. The proposed model is based on the notion of a definite, localized zone of ohmic heating. An analogy is qualitatively drawn between the convection-loaded arc model and a structural beam with a distributed load. The equation of energy balance provides the temperature distribution through the arc model from which the curvature, "flexural rigidity" and deflection curve are determined. Also included is a tentative criterion for blowout. (Author)

Wave Propagation

Ballistic Research Labs., Aberdeen Proving Ground, Md.
PRELIMINARY INVESTIGATION OF THE SHOCK WAVE PROPAGATED FROM THE OPEN END OF A CYLINDRICAL SHOCK TUBE, by Glenn P. Beichler and Leonard P. Grady. Jan 54, 17p. 3 refs. Technical note no. 843; AFSWP no. 768.
Order from LC mi$2.40, ph$3.30 PB 138 676

By means of an array of gauges mounted beyond the open end of a shock tube, pressure-time records were obtained. The results indicate a tendency toward formation of a spherical wave front covering a wide solid angle at a distance from the end of the tube. When a pseudo-spherical front has been formed, similarities exist between the positive phase of pressure-time records obtained from free-air explosions and those obtained by this method but durations and pressure decay with distance do not scale with those of free-air explosions.

Columbia U. School of Engineering, New York.
HE_{11} EXCITED DIELECTRIC SURFACE WAVE RADIATORS, by S. P. Schlesinger and A. Vigants. Technical rept. no. 1 on Contract AF 19(604)3879. 1 June 59, 76p. 20 refs. AFCRC-TN-59-573; CU-5-59-AF-3879-EE; AD-228 309.
Order from LC mi$4.50, ph$12.30 PB 144 420

A solution is presented, using Huyghens' Principle formulated in terms of a Green's function approach, to the radiation problem for the dielectric image line of finite length on an infinite image surface, or the equivalent full round rod, excited in the HE_{11} mode. The integration of appropriate electric and magnetic current sources over the sides and end of the dielectric element yields an expression for the radiation intensity. This is modified to include a weighting function and a reflection coefficient to account for launching effects and the rod end discontinuity. A comparison with earlier simplified theory is made, and the extent to which the results may predict such properties as side lobe characteristics and E- and H-plane differences is presented.

Institute of Mathematical Sciences, New York U., N. Y.
A NEW METHOD FOR THE DETERMINATION OF FAR FIELDS WITH APPLICATIONS TO THE PROBLEM OF RADIATION OF A LINE SOURCE AT THE TIP OF AN ABSORBING WEDGE, by F. C. Karal, Jr. and S. N. Karp. Rept. on Contract AF 19(604)5238. Sep 59, 31p. 9 refs. Research rept. no. EM-145; AFCRC-TN-59-596.
Order from LC mi$3.00, ph$6.30 PB 144 435

A new simple operational method for the determination of the diffracted far field for wedges with impe-

dance boundary conditions is presented. The exterior angle of wedge is $2\pi - \frac{\pi}{2n}$, where n is an integer. The excitation may be either an incident plane wave or a line source. The method is described in detail for the case of an absorbing wedge with a line source located at the tip. Several examples are given to illustrate the method. It is also shown that the method can be applied directly to the classical problem of perfectly conducting wedges.

Institute of Mathematical Sciences, New York U., N. Y.
ON THE DETERMINATION OF THE FREE ELECTRON DISTRIBUTION OF AN IONIZED GAS, by Irvin Kay. Rept. on Contract AF 19(604)3495. Sep 59, 33p. 8 refs. Research rept. no. EM-141; AFCRC-TN-59-591.
Order from LC mi$3.00, ph$6.30 PB 144 436

A standard simplified model of the problem of determining the free electron distribution in an ionized gas by radio sounding experiments is discussed, and a relation between the elements of the corresponding scattering matrix is derived. Under the conditions assumed, a closed form expression for the charge distribution in terms of a reflection coefficient which is a rational function of frequency is obtained.

Institute of Mathematical Sciences, New York U., N. Y.
REFLECTION AND TRANSMISSION BY A CLASS OF CURVED DIELECTRIC LAYERS, by S. N. Karp. Rept. on Contract AF 19(604)5238. Aug 59, 20p. 2 refs. Research rept. no. EM-140; AFCRC-TN-59-584.
Order from LC mi$2.40, ph$3.30 PB 144 427

We consider the reflection and transmission of electromagnetic waves by a special class of curved dielectric layers. The layers in question are bounded by two non-intersecting confocal parabolas, and between these boundaries, the dielectric constant, which may be complex, has a special form of space dependence. It is found that layers of this type have striking properties. If a plane wave is normally incident on such a layer, from the convex side, then the reflected field can be expressed as a product of two factors. The first factor is the field which would be reflected by a conducting parabola coincident with the surface of the layer. The second factor has no space dependence; it depends only upon the spacing of the shell boundaries, the frequency and the special choice of dielectric constant. The transmitted wave has an especially simple form. It is a plane wave. The configuration thus has properties similar to those of a plane dielectric slab. In fact, the plane slab is a limiting case of the geometry we have described.

Ionosphere Research Lab., Pennsylvania State U., University Park.
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF THE LOW FREQUENCY POLARIZATION AT 60, 75 AND 150 KC/S, by A. J. Ferraro. Scientific rept. no. 121 on Ionospheric Research, Contract AF 19(604)4563. 13 July 59, 100p. 15 refs. AFCRC-TN-59-632.
Order from LC mi$5.40, ph$15.30 PB 144 440

The instrumentation for recording the state of polarization of 60 kc/s and 75 kc/s echoes for vertical incidence radio soundings is described in detail. Basically, the equipment resolves the polarization ellipse into its two circularly polarized components: the ordinary and extraordinary modes. The results of thirteen months of recording in the intervals of December 1956 to April 1957 on 75 kc/s and October 1957 to May 1958 on 60 kc/s are presented as monthly averages. In addition, a few typical daily curves of polarization for magnetically quiet and disturbed days are discussed. A catalogue of 25 ionospheric models for which the group height, phase height, absorption, and polarization have been computed for 60-75 kc/s and 150 kc/s are presented.

Ionosphere Research Lab., Pennsylvania State U., University Park.
IONOSPHERIC INVESTIGATION FROM SATELLITE RADIO OBSERVATIONS. 1. DOPPLER EFFECT RECORDING INSTRUMENTATION, by W. J. Ross. Scientific rept. no. 120 on Ionospheric Research, Contract AF 19(604)4563. 30 June 59, 86p. 14 refs. AFCRC-TN-59-631; AD-227 909.
Order from LC mi$4.80, ph$13.80 PB 144 439

A brief survey is made of the main features of satellite transmitters and of the ionospheric propagation effects produced in the radio waves from them. From these considerations the desirable properties of the transmitter are summarized and the necessary properties of the receiving apparatus are inferred. Detailed descriptions of the various units of the receiving instrumentation are then given, followed by the presentation of a sample record analyzed to yield electron content of the ionosphere.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
GUIDED WAVES ON SINUSOIDALLY MODULATED REACTANCE SURFACES, by A. A. Oliner and A. Hessel. Rept. on Contract AF 19(604)2031. 14 Sep 59, 32p. 6 refs. Research rept. R-777-59; PIB-705; AFCRC-TN-59-771.
Order from LC mi$3.00, ph$6.30 PB 144 423

A rigorous solution is derived for the propagation characteristics and field distributions of waves guided by a plane surface which possesses a surface reactance modulated sinusoidally in the propagation direction. The explicit field amplitudes and the determinantal equation for the propagation wavenumber are expressed in a continued fraction form which is rapidly convergent for all values of modulation. Numerical results are obtained for both surface wave (modal) and leaky wave (non-modal) solutions. The relevance of these studies to high gain modulated surface wave antennas is discussed.

National Bureau of Standards, Boulder, Colo.
COMMUNICATION THEORY ASPECTS OF TELEVISION BANDWIDTH CONSERVATION, by William C. Coombs. Aug 59, 27p. 10 refs. Technical note no. 25.
Order from OTS $0.50 PB 151 384

New concepts of communication bandwidth utilization and conservation are in prospect through difference signal modulation systems in which only relative changes information is transmitted in lieu of absolute amplitudes. By these systems, the changes data function is made one of time as well as of amplitude, so that better advantage can be taken of redundancies in the video signal. Advantageous conversions of information rate are made feasible by reason of a tremendous disparity existing between the extremely high information capacity of conventional television systems and the relatively very low perception capability of a human observer channel. Information conversions more consistent with perception capabilities of the human channel are achieved in difference signal modulation without usual great expansion of bandwidth that would be required to reproduce every possible absolute amplitude of each datum in the whole video picture mosaic directly. Conversion to binary digital form accrues the further advantages of binary systems, including greater immunity to noise, greater adaptability to discrete data storage media, greater ease of scrambling for security, and greater amenability of encoding to optimum parametric controls for most advantageous transmission. (Author)

National Bureau of Standards, Boulder, Colo.
DESIGN OF SINGLE FREQUENCY FILTERS, by Forrest F. Fulton, Jr. 20 Aug 59, 10p. 1 ref. Technical note no. 23.
Order from OTS $0.50 PB 151 382

Efficient procedures are shown for designing filters formed by a number of identical resonant circuits loosely coupled together, and which are required to accept one narrow band of frequencies and reject another narrow band somewhat removed in frequency, without any special requirements on the shape of the attenuation curve in between these regions. The design is based on using a large number of sections. (Author).

National Bureau of Standards, Washington, D. C.
FREQUENCY DEPENDENCE OF VHF IONOSPHERIC SCATTERING, by James C. Blair. Apr 59, 17p. 11 refs. Technical note no. 9.
Order from OTS $0.75 PB 151 368

This report contains data obtained by recording received signal intensities simultaneously at five frequencies over the 1295 km path between the Long Branch transmitting station at Long Branch, Illinois, and the receiving site at Boulder, Colorado (Table Mesa field station). The data presented here cover the period of September 1, 1957 to June 30, 1958 (except for some later data on meteor bursts and sudden ionospheric disturbances). Good simultaneous signal intensity records were obtained for most of this period on 30, 40, 50 and 74 Mc. The available transmitter at 108 Mc was not suitable for continuous reliable records prior to June 5, 1958. A set of high-speed records was made for 10-minute intervals at different times during one day and analyzed for amplitude-distribution and fading-rate. Also, a low-sensitivity recording was made for the study of meteor bursts. Data presented here show the measured results of frequency dependence of average received power and illustrate how the level of average received power is influenced by meteoric ionization, sporadic-E ionization, and ionospheric and magnetic disturbances. A summary of hourly median and upper and lower decile values on all frequencies is included, as well as data on amplitude distributions and fading rates.

National Bureau of Standards, Boulder, Colo.
A HISTORY OF VERTICAL-INCIDENCE IONOSPHERE SOUNDING AT THE NATIONAL BUREAU OF STANDARDS, by Sanford C. Gladden. Sep 59, 140p. 191 refs. Technical note no. 28.
Order from OTS $2.00 PB 151 387

National Bureau of Standards, Boulder, Colo.
RADIO NOISE DATA FOR THE INTERNATIONAL GEOPHYSICAL YEAR JULY 1, 1957-DECEMBER 31 1958, by W. Q. Crichlow, C. A. Samson and others. 27 July 59, 239p. 1 ref. Technical note no. 18.
Order from OTS $2.50 PB 151 377

During the International Geophysical Year, radio noise measurements were made by a world-wide network supervised by the National Bureau of Standards. The months in which usable data were obtained are shown, and the results of the measurements are summarized. Month-hour data for each station are given first, followed by the seasonal-time-block values. In order to conform to the seasonal pattern used in CCIR Report No. 65, the data for June 1957 and January and February 1959 have been included.

National Bureau of Standards, Boulder, Colo.
RADIO WAVE PROPAGATION IN AN INHOMOGENEOUS ATMOSPHERE, by James R. Wait. 10 Sep 59, 21p. 20 refs. Technical note no. 24.
Order from OTS $1.00 PB 151 383

A self-contained treatment of the theory of radio waves in an inhomogeneous atmosphere is given. The refractive index is assumed to vary with height above the earth in a monotonic fashion. Variation according to an exponential law is used for illustration of general principles. For this case, rigorous series formulas are developed for the distance to the horizon for an elevated point in the atmosphere. (Author)

National Bureau of Standards, Boulder, Colo.
SURVEY OF CENTRAL RADIO PROPAGATION LABORATORY RESEARCH IN TROPOSPHERIC PROPAGATION 1948-1956, by J. W. Herbstreit and P. L. Rice. Sep 59, 464p. 360 refs. Technical note no. 26.
Order from OTS $4.00 PB 151 385

This report summarizes and abstracts publications concerned with the National Bureau of Standards tropospheric propagation research program dating back to the formation of the Central Radio Propagation Laboratory. Some technical papers are reproduced here as supplements to this report and excerpts from some of the longer technical reports are also included.

National Bureau of Standards, Boulder, Colo.
SERVICE AREA OF AN AIRBORNE TELEVISION STATION, by M. T. Decker. Oct 59, 46p. 9 refs. Technical note no. 35.
Order from OTS $0.75 PB 151 394

As a step in the evaluation of a proposed airborne television network, the service to be expected from an airborne station has been calculated for a wide variety of operating conditions. The use of basic transmission loss to describe the radio propagation effects enables the results to be used when equipment parameters are changed as system requirements and economic considerations dictate.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Fansteel Metallurgical Corp., North Chicago, Ill.
INFORMAL MONTHLY PROGRESS REPORT TO NEPA PROJECT, by Ralph Wehrmann. Rept. for 21 Jan - 20 Feb 49. 5 Apr 49, 10p. NEPA 911-FAN-21; AD-203 996.
Order from LC mi$1.80, ph$1.80 PB 138 323

See also PB 138 322.

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
UNIVERSITIES IN TRANSITION, by A. von Hippel. Dec 58, 10p. Technical rept. 132.
Order from LC mi$1.80, ph$1.80 PB 144 654

Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS, APRIL-JUNE, 1954. Nov 54, 53p. 7 refs. NOLC rept. 211.
Order from LC mi$3.60, ph$9.30 PB 144 558

Contents:
Ferromagnetic resonance
DC-FM converter
Infrared sources
Small antenna investigation
Perfluoroorganic derivatives
(See also PB 143 789)

Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS SPONSORED BY BUREAU OF ORDNANCE. Quarterly rept. for period ending 31 Dec 53. Apr 54, 37p. 7 refs. NOL-Corona rept. 135, pt. 1.
Order from LC mi$3.00, ph$6.30 PB 144 528

Contents:
Multimode transmission
Ferromagnetic resonance
DART
DC-FM converter
Infrared sources
Small antenna investigation
Ground-scrutinizing radar

Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS. Quarterly rept. for Apr-June 59. Sep 59, 74p. 12 refs. NAVORD rept. 5963; NOLC rept. 464.
Order from LC mi$4.50, ph$12.30 PB 144 479

Contents
Communication stochastics, by R. L. Conger
Ferromagnetic resonance, by R. L. Conger and R. W. Sharp
High-temperature polymer program, by D. L. Herring, C. Douglas, and J. Konecny
Infrared atomic spectra, by C. J. Humphreys and E. Paul, Jr.
Organoaluminum and aluminum hydride chemistry, by B. Bartocha, A. J. Bilbo, D. E. Bublitz, C. M. Douglas, N. R. Fetter, and M. Y. Gray
(See also PB 143 249)

Ohio State U. Research Foundation, Columbus.
THE EVOLUTION AND RATIONALE OF THE ICAO WORD-SPELLING ALPHABET, by Henry M. Moser. Technical rept. no. 52 on Contract AF 19(604)4575. 1959, 88p. 9 refs. AFCRC-TN-59-54; AD-227 639.
Order from LC mi$4.80, ph$13.80 PB 144 681

The development of the word-spelling alphabet is traced, and research methods and findings which led to the recommendation of the ICAO alphabet as an optimum list for international communications are summarized. Questions regarding the desirability and efficiency of the new alphabet are discussed, with the view to presenting what the alphabet intends to accomplish. Some 200 word alphabets of the world are appended. (Author)

Photographic Equipment

Ballistic Research [Labs.] Aberdeen Proving Ground, Md.
A SHORTENED METHOD OF STAR-REDUCTION, FOR CALIBRATING BALLISTIC CAMERAS, by R. d'E. Atkinson. 8 Jan 46, 42p. Rept. no. 593.
Order from LC mi$3.30, ph$7.80 PB 145 062

A method is given for reducing the zenith to the equator and equinox of any standard catalogue, so as to eliminate the reductions of individual stars to the apparent equator and equinox of date. The aberration is handled by an approximate method, but the errors introduced by this are very small. Secondly, the standard coordinates, referred to an astronomical azimuth, are now given directly by closed formulae, so that it is no longer necessary to solve explicitly for azimuth and zenith distance for each star. The number of references per star to seven figure trigonometrical tables is reduced by this from eleven to three, and the total amount of computation is correspondingly cut down.

Rome Air Development Center, Griffiss AFB, N. Y.
AUTOMATIC CAMERA CONTROL SYSTEM, by

James B. Hickey, Joseph P. Gendron, and John R. Bratge. Sep 59, 19p. RADC-TR-59-136.
Order from LC mi$2.40, ph$3.30 PB 144 407

This report presents the theory of operation and a technical description of an automatic camera control system designed and fabricated by the QRC Branch of the Rome Air Development Center.

SOCIAL SCIENCES

Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsburgh, Pa.
A STUDY OF SALES FLUCTUATIONS IN TERMS OF PROBABILITY DISTRIBUTIONS, by Sharu S. Rangnekar and Charles C. Holt. ONR Research memo. no. 46 on Planning and Control of Industrial Operations, Contract Nonr-760(01). Aug 56, 23p. 8 refs.
Order from LC mi$2.70, ph$4.80 PB 138 505

In order to make decisions regarding production and inventory in a manufacturing concern or regarding inventory in a distributing concern, it is necessary to predict the future sales. When the future sales are uncertain - which is the usual case - some knowledge of the probable forecast error is also needed for arriving at an optimum decision. One approach to the sales forecast problem is to try to forecast the mean (average) sales rate and treat the deviation from the mean as an (unforcastable) random variable with a known probability distribution. This paper is concerned with this random component of sales. The prediction of mean sales is not considered.

Stanford U., Calif.
WELFARE ECONOMICS AND EXISTENCE OF AN EQUILIBRIUM FOR A COMPETITIVE ECONOMY (II) by Takashi Negishi. Technical rept. no. 65 on Contract N6onr-25133. 23 Dec 58, 8p. 5 refs.
Order from LC mi$1.80, ph$1.80 PB 144 672

This is a sequel to "Welfare Economics and Existence of an Equilibrium for a Competitive Economy I". In this is given another proof of the existence of a competitive equilibrium as an efficient state of the system by the more objective, measurable concepts such as incomes and expenditures. (See also PB 143 843)

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS, Feb 60.
Order from OTS $1.25, $10.00/year PB 161 278

Contents:
Articles:
The profile of the solar Lyman-alpha line of hydrogen, by C. R. Detwiler, J. D. Purcell, and R. Tousey
Aus-worked 12% chromium steel with high yield strength and fracture resistance, by J. E. Srawley and T. C. Lupton
Electron probe measurements of evaporated metal films, by W. E. Sweeney, Jr., R. E. Seebold, and L. S. Birks
Scientific program:
Astronomy and Astrophysics: Airglow emissions in the night sky. Ultraviolet radiations from celestial sources; small extreme ultraviolet telescope flown for the first time in NRL rocket astronomy experiments
Chemistry: Chemical constituents of submarine atmospheres
Mechanics: Validity of using uncorrected velocity meter records to compute shock spectra
Metallurgy and Ceramics: Titanium alloy ingots fabricated into wrought form, without contamination, by a hot extrusion process. Determination of phosphorus in titanium. Heat treatment of Mn-V-Mo age-hardening austenitic steel
Nuclear and Atomic Physics: Stark broadening of hydrogen lines in a plasma for the temperature range 10,000°K to 40,000°K. Calculation of energy absorbed by organic materials exposed to high-intensity radiation fields
Optics: Infrared transmission of the atmosphere
Radio: Newly developed submarine rescue buoy transmits tone-modulated Morse code distress signals readable at ranges from 25 to 83 nautical miles. Transfer characteristics of a gated strip of i-f amplifiers
Solid State Physics: Redesigned thermoluminescent dosimeter responds linearly to doses from 1 milliroentgen up to at least 1000 roentgens. Development of colloids in additively colored sodium chloride
Sound: Theoretical analysis of echo formation in the fluctuation environment of the sea
Supporting Techniques:
A seal for lithium fluoride windows

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Biology and Medicine

Uptake of radioisotopes and their transfer through food chains by marine organisms, by S. J. Townsley, D. F. Reid, and W. T. Ego. University of Hawaii. Hawaii Marine Laboratory, Honolulu, Hawaii. 1958-1959. Contract AT (04-3)-56. 47p. Order from LC. Mi $3.30, ph $7.80. AECU-4350

Turnover of labeled amino acids and proteins in cancerous tissues and mammals. Literature search, by M. Comstock. Brookhaven National Laboratory, Upton, N. Y. Oct 58. 5p. Order from LC. Mi $1.80, ph $1.80. AECU-4357

Effect of proton and deuteron irradiation on biological material. Bibliography, by M. Comstock. Brookhaven National Laboratory, Upton, N. Y. Sep 58. 2p. Order from LC. Mi $1.80, ph $1.80. AECU-4358

Respiratory pathways in fungi and actinomycetes. Final report for January 1, 1956 to June 30, 1959, by V. W. Cochrane. Wesleyan University, Middletown, Conn. Sep 59. Contract AT(30-1)-1813. 29p. Order from LC. Mi $2.70, ph $4.80. AECU-4366

Studies of the effects of ionizing radiation on the ultrastructure of developing nervous tissue as revealed by electron microscopy. Annual report for November 1, 1958 to October 31, 1959, by H. Fernandez-Moran. Massachusetts. General Hospital. Mixter Laboratories for Electron Microscopy, Boston, Mass. 1959. Contract AT(30-1)-2278. 36p. Order from LC. Mi $3.00, ph $6.30. AECU-4405

Study of long-term pathologic effects of radioactive isotopes of calcium and strontium in bone and soft tissues, especially with reference to bone tumor production. Final technical report for May 16, 1958-August 31, 1959, by J. F. Kuzma and G. E. Zander-Principati. Marquette University. School of Medicine, Milwaukee, Wis. 1959. Contract AT(11-1)-105. 63p. Order from LC. Mi $3.90, ph $10.80. AECU-4409

The development of radiochemical analyzers for non-radioactive gases and study of radioactive clathrates. Yearly report, by D. J. Chleck and others. Tracerlab, Inc., Waltham, Mass. July 59. Contract AT(30-1)-2204. 41p. Order from OTS. $1.25. AECU-4493

Radiological Physics Division semiannual report for January through June 1959, by J. E. Rose and L. D. Marinelli. Argonne National Laboratory, Lemont, Ill. Oct 59. Contract W-31-109-eng-38. 101p. Order from OTS. $2.50. ANL-6049

Medical gamma-ray spectrometry, by D. A. Ross. Oak Ridge Institute of Nuclear Studies, and Basic principles of scintillation counting for mdeical investigators, by C. C. Harris, D. P. Hamblen, and J. E. Francis. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 72p. Order from OTS. $2.00. ORNL-2808/ORINS-30

Radiation background in Albuquerque, New Mexico, during and after the teaport series, by H. H. Sander and T, B, Cook, Jr. Sandia Corp., Albuquerque, N. Mex. Sep 55. 12p. Order from LC. Mi $2.40, ph $3.30. SCTM-206-55-(51)

Origin of life on earth and elsewhere, by M. Calvin. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Dec 59. Contract W-7405-eng-48. 44p. Order from OTS. $1.25. UCRL-9005

Radiation effect on the permeability of yeast cells to sodium and potassium ions. Thesis, by Kwan Hsu. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Dec 59. Contract W-7405-eng-48. 101p. Order from OTS. $2.50. UCRL-9012

Chemistry—General

High sensitivity mass spectrometry of the rare gases, by O. A. Schaeffer. Brookhaven National Laboratory, Upton, N. Y. Dec 59. 12p. Order from OTS. 50 cents. BNL-581 (T-161)

Separation factor and transfer coefficients associated with ion exchange separation of enriched as-depleted As., by S. H. Jury. Oak Ridge National Laboratory, Oak Ridge, Tenn. Aug 52. Decl. Dec 17, 1958. Contract W-7405-eng-26. 14p. Order from LC. Mi $2.40, ph $3.30. CF-52-8-218

Size of U. S. Steam-electric plants, by R. C. Robertson. Oak Ridge National Laboratory, Oak Ridge, Tenn. May 59. Contract W-7405-eng-26. 15p. Order from LC. Mi $2.40, ph $3.30. CF-59-5-130

A colorimetric method for rapid determination of traces of selenium, by E. M. Ray. Goodyear Atomic Corporation. Technical Division, Chemical Analysis Department, Portsmouth, Ohio. Dec 59. Contract AT-(33-2)-1. 10p. Order from OTS. 50 cents. GAT-289

Infrared spectra of ClO_2, ClO_2F, and ClO_3F, by E. A. Smith, F. C. Steinbach, and K. E. Beu. Goodyear Atomic Corp., Portsmouth, Ohio. Oct 59. Contract AT(33-2)-1. 6p. Order from LC. Mi $1.80, ph $1.80. GAT-T-687

The melting points of uranium dioxide, uranium monocarbide, and uranium mononitride, by H. W. Newkirk and J. L. Bates. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. Mar 59. 5p. Order from LC. Mi $1.80, ph $1.80. HW-59468

Decontamination studies for HAPO high temperature reactor recirculation systems. Progress report June 1958-June 1959, by L. D. Perrigo and R. D. Weed. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. June 59. Contract W-31-109-Eng-52. 34p. Order from LC. Mi $3.00, ph $6.30. HW-60677

Zirconium extraction by tributyl phosphate, by R. L. Hickok and R. D. Cannon. Phillips Petroleum Co. Atomic Energy Division, Idaho Falls, Idaho. Nov.59. Contract AT(10-1)-205. 50p. Order from OTS. $1.25. IDO-14487

Research report in engineering. Semi-annual summary for January-June 1959, by Ames Laboratory Staff. Iowa State University of Science and Technology, Ames Laboratory, Iowa City, Iowa. Nov 59. Contract W-7405-eng-82. 27p. Order from OTS. $1.00. IS-16

Misidentifications in the ARC spectra of the rare earths, by R. N. Kniseley, V. A. Fassel and C. F. Lentz. Iowa State University of Science and Technology, Ames Laboratory, Iowa City, Iowa. Nov 59. Contract W-7405-eng-82. 21p. Order from OTS. 75 cents. IS-50

Organic fluorine compounds prepared by the electrochemical method. Literature survey, 1950 - July 1959, by S. A. Shahan. Union Carbide Nuclear Co. Division of Union Carbide Corporation. Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tenn. Jan 60. Contract W-7405-eng-26. 20p. Order from OTS. 75 cents. K-1438

The determination of chlorine in polyurethane plastic, by A. L. Henicksman, E. H. VanKooten, R. D. Gardner, and W. H. Ashley. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Dec 59. Contract W-7405-ENG-36. 11p. Order from OTS. 50 cents. LA-2362

Estimated upper bounds to the half-life of thermal decomposition of ammonia, hydrogen, methane, and propane, by D. Herschbach. Los Alamos Scientific Laboratory, N. Mex. Aug 55. Decl. Aug 11, 1959. Contract W-7405-eng-36. 30p. Order from LC. Mi $2.70, ph $4.80. LAMS-1954

Process development of 2, 2-dinitropropyl acrylate, by T. M. Benziger, R. K. Rohwer, and W. H. Stein. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Oct 55. Decl. Sep 25, 1959. Contract W-7405-eng-36. 45p. Order from LC. Mi $3.30, ph $7.80. LAMS-1974

Solubility of terphenyls at room temperature, by R. T. Keen. North American Aviation, Inc., Atomics International Division, Canoga Park, Calif. Jan 58. 4p. Order from LC. Mi $1.80, ph $1.80. NAA-SR-MEMO-2412

Thermo-physical properties of OMRE circulating coolant, by G. Asanovich. North American Aviation, Inc., Atomics International Division, Canoga Park, Calif. May 59. 16p. Order from LC. Mi $2.40, ph $3.30. NAA-SR-MEMO-3843

The system lithium hydride--calcium hydride, by C. E. Messer and J. A. Krol. Tufts University, Medford, Mass. Sep 59. Contract AT(30-1)-1410. 12p. Order from LC. Mi $2.40, ph $3.30. NYO-8026

Thorex pilot plant corrosion studies: II. Corrosion of types 304L, 309SCb, and 347 stainless steel during development and production-development periods, by J. L. English. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 48p. Order from OTS. $1.50. ORNL-2844

Pilot plant preparation of thorium- and thorium-uranium oxides, by K. O. Johnsson and R. H. Winget. Oak Ridge National Laboratory, Chemical Technology Division, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 16p. Order from OTS. 75 cents. ORNL-2853

A study of spectrophotometric methods for the determination of osmium, by G. Goldstein. Oak Ridge National Laboratory, Analytical Chemistry Division, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 69p. Order from OTS. $2.25. ORNL-2862

Master analytical manual, by M. T. Kelley. Oak Ridge National Laboratory, Analytical Chemistry Division, Oak Ridge, Tenn. Nov 59. 527p. Order from OTS. $5.75. TID-7015 (SUPPL. 1)

A method of purification of Americium, by Keiji Naito. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Nov 59. Contract W-7405-eng-48. 23p. Order from OTS. 75 cents. UCRL-8748

The gravimetric determination of hafnium and zirconium in hafnium materials, by T. M. Reinhold. Westinghouse Electric Corp., Bettis Plant, Pittsburgh, Pa. Apr 59. 4p. Order from LC. Mi $1.80, ph $1.80. WAPD-M-(GLA)-718

Recovery of uranium from uranium-zirconium fuel scrap, by T. P. Sprague. Union Carbide Nuclear Co. Division of Union Carbide Corp. Y-12 Plant, Oak Ridge, Tenn. Jan 58. Contract W-7405-eng-26. 27p. Order from OTS. $1.00. Y-1282

Chemistry—Radiation and Radiochemistry

Theoretical and experimental studies of sodium irradiator systems, by O. A. Kuhl, L. Galanter, S. Zwickler, and B. Manowitz. Brookhaven National Laboratory, Upton, N. Y. May 59. 19p. Order from OTS. 75 cents. BNL-567 (T-153)

Chemistry—Separation Processes for Plutonium and Uranium

Chemical Engineering Division summary report for July, August, September, 1959, by S. Lawroski. and others. Argonne National Laboratory, Lemont, Ill. 1959. Contract W-31-109-eng-38. 165p. Order from OTS. $3.00. ANL-6068

PRFR pilot leaching plant--preliminary process design, by H. A. McLain. Oak Ridge National Laboratory, Oak Ridge, Tenn. July 59. Contract W-7405-eng-26. 50p. Order from LC Mi $3.60, ph $9.30. CF-59-7-76

A gelatin-filtration headend for fuel reprocessing solutions from silicon-containing aluminum alloys, by B. J. Newby and B. E. Paige. Phillips Petroleum Co., Atomic Energy Division, Idaho Falls, Idaho. Feb 59. Contract AT(10-1)-205. 54 pages. Order from OTS. $1.50. IDO-14468

Idaho Chemical Processing Plant technical progress report for January through March 1959, by C. E. Stevenson and others. Phillips Petroleum Co., Atomic Energy Division, Idaho Falls, Idaho. Aug 59. Contract AT(10-1)-205. 71p. Order from OTS. $2.00. IDO-14471

The determination of excessive emulsification by coalescence behavior measurements, by O. W. Parrett. Phillips Petroleum Co., Atomic Energy Division, Idaho Falls, Idaho. Nov 59. Contract AT(10-1)-205. 25p. Order from OTS. 75 cents. IDO-14486

Electrorefining of irradiated thorium-uranium alloy, by W. N. Hansen, W. L. Long, and E. W. Murbach. Atomics International, A Division of North American Aviation, Inc., Canoga Park, Calif. Jan 60. Contract AT(11-1)-GEN-8. 14p. Order from OTS. 75 cents. NAA-SR-4660

Modified zirflex process for dissolution of zirconium- and niobium-bearing nuclear fuels in aqueous fluoride solutions: Laboratory development, by T. A. Gens and F. G. Baird. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 30p. Order from OTS. $1.00. ORNL-2713

Controlled Thermonuclear Processes

Thermonuclear project semiannual report, for period ending July 31, 1959, by A. H. Snell and others. Oak Ridge National Laboratory, Oak Ridge, Tenn. 1959. Contract W-7405-eng-26. 136p. Order from OTS. $2.75. ORNL-2802

Some exact radiating solutions to Vlasov's equations, by L. C. Biedenharn. Oak Ridge National Laboratory, Oak Ridge, Tenn. 1959. Contract W-7405-eng-26. 20p. Order from OTS. 75 cents. ORNL-2838

Kinetic equations for plasma and radiation, by A. Simon and E. G. Harris. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 33p. Order from OTS. $1.25. ORNL-2880

Current sources for scaling magnetic fields, by S. C. Snowdon. Midwestern Universities Research Association, Madison, Wis. Dec 59. Contract AT(11-1)-384. 21p. Order from OTS. 75 cents. MURA-535

The hard-core pinch. Part I, by D. H. Birdsall, S. A. Colgate, and H. P. Furth. University of California. Lawrence Radiation Laboratory, Livermore, Calif. July 59. Contract W-7405-eng-48. 13p. Order from LC. Mi $2.40, ph $3.30. UCRL-5599

The hard-core pinch. Part II, by D. H. Birdsall, S. A. Colgate, and H. P. Furth. University of California. Lawrence Radiation Laboratory, Livermore, Calif. July 59. Contract W-7405-eng-48. 15p. Order from LC. Mi $2.40, ph $3.30. UCRL-5602

Criticality Studies

Nuclear calculations for the organic moderated exponential experiments, by J. J. McClure. Atomics International, Division of North American Aviation, Inc., Canoga Park, Calif. Mar 59. 8p. Order from LC. Mi $1.80, ph $1.80. NAA-SR-MEMO-3659

Critical mass of an OMR core using plate type fuel elements, by H. C. Field. Atomics International, A Division of North American Aviation, Inc., Canoga Park, Calif. June 59. 4p. Order from LC. Mi $1.80, ph $1.80. NAA-SR-MEMO-3980

Health and Safety

Radiochemical analysis of marine biological samples following the "Redwing" shot series - 1956, by C. W. Thomas, D. L. Reid, and L. F. Lust. Hanford Atomic Products Operation, Richland, Wash. Dec 58. Contract W-31-109-Eng-52. 81p. Order from OTS. $2.25. HW-58674

Hanford environmental monitoring annual report, 1958, by B. V. Andersen. Hanford Atomic Products Operation, Richland, Wash. Aug 59. Contract AT(45-1)-1350. 18p. Order from OTS. 75 cents. HW-61676

Prevention and handling of radiation emergencies, by K. W. Bahler, A. F. Rupp, R. H. Lafferty, Jr., J. W. Wachter, and L. S. O'Rourke. Union Carbide Nuclear Co., Division of Union Carbide Corporation, Oak Ridge, Tenn. and Paducah, Ky., and Goodyear Atomic Corp., Portsmouth, Ohio. Dec 59. Contracts W-7405-eng-26 and AT-(33-2)-1. 68p. Order from OTS. $2.00. K-1436

Measurement of radioactive fallout air sedimentation apparatus, by J. F. Lakner. University of California. Lawrence Radiation Laboratory, Livermore, Calif. July 59. Contract W-7405-eng-48. 34p. Order from OTS. $1.00. UCRL-5636

Instruments

Manipulator cable with constant stress, by J. H. Grimson. Argonne National Laboratory, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 44p. Order from OTS. $1.25. ANL-6079

A scintillation transistorized alpha-beta-gamma hand and shoe counter, by W. G. Spear. Hanford Atomic Products Operation, Richland, Wash. July 59. Contract AT(45-1)-1350. 105p. Order from OTS. $2.50. HW-60631

An automatic analyzing monitor for reactor effluent cooling water, by H. G. Rieck, C. A. Ratcliffe and L. C. Schwendiman. Hanford Atomic Products Operation, Richland, Wash. May 59. Contract W-31-109-Eng-52. 69p. Order from OTS. $2.00. HW-61117

Differential pressure safety device, by R. Holland. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Jan 59. Contract AT(11-1)-GEN-8. 28p. Order from OTS. $1.00. NAA-SR-3867

The lid tank shielding facility at Oak Ridge National Laboratory. Part III. Instrumentation, by D. W. Cady. Oak Ridge National Laboratory, Oak Ridge, Tenn. 1959. Contract W-7405-eng-26. 58p. Order from OTS. $2.00. ORNL-2587

On the relationship between DC large signal current gain and AC small signal current gain for a common base transistor connection, by T. E. Lommasson. Sandia Corporation, Albuquerque, N. Mex. Oct 55. 4p. Order from LC. Mi $1.80, ph $1.80. SCTM-219-55-53

Transducer system response tests, by R. Masnovi. Westinghouse Electric Corp. Atomic Power Division, Pittsburgh, Pa. Oct 58. 26p. Order from LC. Mi $2.70, ph $4.80. WAPD-TH-450

Metallurgy and Ceramics

Thermodynamic properties of carbides at high temperatures. Annual report and renewal proposal, by S. Fujishiro and N. A. Gokcen. University of Pennsylvania, Philadelphia, Pa. Sep 59. 8p. Order from LC. Mi $1.80, ph $1.80. AECU-4346

Using ceramics and cermets in nuclear power reactors, by G. L. Ploetz. Knolls Atomic Power Laboratory, Schenectady, N. Y. [nd]. 21p. Order from LC. Mi $2.40, ph $3.30. AECU-4354

Apparatus for measuring the thermal conductivities of metals, by S. T. Zegler and M. V. Nevitt. Argonne National Laboratory, Lemont, Ill. Oct 59. Contract W-31-109-eng-38. 15p. Order from OTS. 50 cents. ANL-5611

Casting of zirconium containing small internal cooling holes, by D. S. Parker. General Electric Co., Atomic Product Division, Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. Nov 59. Contracts AT(11-1)-171 and AF 33(600)-38062. 11p. Order from OTS. 50 cents. APEX-538

High-temperature irradiation of a zirconium-hydride-2 w/o uranium alloy, by G. E. Lamale and others. Battelle Memorial Institute, Columbus, Ohio. Dec 59. Contract W-7405-eng-92. 37p. Order from OTS. $1.25. BMI-1401

Effect of additions to Zircaloy on hydrogen pickup during aqueous corrosion, by W. E. Berry, E. L. White, and F. W. Fink. Battelle Memorial Institute, Columbus, Ohio. Dec 59. Contract W-7405-eng-92. 30p. Order from OTS. $1.00. BMI-1402

Estimates of the effect of bubble size on fuel element swelling, by A. H. Willis. General Electric Co., Knolls Atomic Power Laboratory, Schenectady, N. Y. Sep 59. Contract W-31-109-Eng-52. 13p. Order from OTS. 75 cents. KAPL-2050

Prediction of high temperature tensile and creep properties from hot hardness tests of a Zr-Nb-Sn alloy, by D. L. Douglass. General Electric Co., Knolls Atomic Power Laboratory, Schenectady, N. Y. Aug 59. Contract W-31-109-Eng-52. 8p. Order from OTS. 75 cents. KAPL-2051

Measurement and interpretation of electrical properties of zirconium hydride for hydrogen-to-metal ratios between 1.5 and 2, by P. W. Bickel. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Jan 60. Contract AT(11-1)-GEN-8. 12p. Order from OTS. 50 cents. NAA-SR-4173

Interim report on the aluminum powder metallurgy product development program, by W. H. Friske. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Jan 60. Contract AT(11-1)-GEN-8. 34 pages. Order from OTS. $1.00. NAA-SR-4233

Apparatus for determining linear thermal expansions of materials in vacuum or controlled atmosphere, by S. D. Fulkerson. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 37p. Order from OTS. $1.25. ORNL-2856

Development and properties of silver-base alloys as control rod materials for pressurized water reactors, by I. Cohen. Westinghouse Electric Corporation. Bettis Atomic Power Laboratory, Pittsburgh, Pa. Dec 59. Contract AT-11-1-GEN-14. 118p. Order from OTS. $2.75. WAPD-214

Particle Accelerators and High-Voltage Machines

Beat factors for an accelerator with a general magnetic field, by G. Parzen. Midwestern Universities Research Association, Madison, Wis. Sep 59. Contract AT(11-1)-384. 5p. Order from OTS. 50 cents. MURA-513

Fields excited by beam currents in circular accelerators, by J. Van Bladel. Midwestern Universities Research Association, Madison, Wis. Dec 59. Contract AT(11-1)-384. 22p. Order from OTS. 75 cents. MURA-538

The admittance and transfer functions of solid core electromagnets, by N. F. Ziegler. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 51p. Order from OTS. $1.75. ORNL-2860

Bevatron operation and development. XXI, February, March, April 1959, by W. D. Hartsough. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Oct 59. Contract W-7405-eng-48. 22p. Order from OTS. 75 cents. UCRL-8927

Physics and Mathematics

Annular fixed-bed ion-exchange studies, by G. A. Nicholson. Hanford Atomic Products Operation, Richland, Wash. May 59. Contract W-31-109-Eng-52. 29p. Order from OTS. $1.00. HW-59709

Nuclear physics research quarterly report for April, May, June, 1959, by J. E. Faulkner and others. Hanford Atomic Products Operation, Richland, Wash. July 59. Contract AT(45-1)-1350. 58p. Order from OTS. $1.75. HW-61181

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SOURCE INDEX

Source	Page	PB Number
Adjutant General's Office, Washington, D. C.	354	144 671
Aerojet-General Corp., Azusa, Calif.	401	137 840
	403	144 571
Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio	361	161 312
	411	161 318
Aeronutronic, Newport Beach, Calif.	388	144 731
	426	144 412
Aerophysics Development Corp., Santa Barbara, Calif.	412	144 695
		145 001
		145 064
Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio	356	161 335
	359	161 333
	370	161 334
Air Force, Washington, D. C.	396	161 357
Air Force Cambridge Research Center, Bedford, Mass.	426	144 418
	366	144 602
		161 346
	368	161 344
	369	161 289
		161 341
	388	161 340
	404	144 588
	423	161 345
	428	144 587
		161 342
		161 343
Air Force Missile Development Center, Holloman AFB, N. Mex.	358	144 424
	370	144 596
	428	144 594
Air Force Missile Test Center, Patrick AFB, Fla.	368	143 235
	374	144 441
	388	144 421
Aircraft Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio	371	144 802
Albany Medical Coll., N. Y.	359	144 688
Alco Products, Inc., Schenectady, N. Y.	422	145 024
Andersen Labs., Inc., West Hartford, Conn.	375	144 417
Anderson Physical Lab., Champaign, Ill.	428	161 336
Antenna Lab., Calif. Inst. of Tech., Pasadena	389	137 903
Antioch Coll., Yellow Springs, Ohio	356	161 335
Applied Mathematics and Statistics Lab., Stanford U., Calif.	356	137 997
	404	144 763
	405	144 813
	408	144 556
Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.	389	144 719
	397	144 718
Applied Psychological Services, Wayne, Pa.	356	144 790
Arizona State Coll., Flagstaff	353	144 583
	366	144 584
Arizona U. Coll. of Agriculture, Tucson	360	143 349
Arkansas U., Fayetteville	362	137 724
Army Chemical Warfare Labs., Army Chemical Center, Md.	359	138 343
	360	144 666
		144 668
		144 684
	362	144 740
Army Engineer Research and Development Lab., Fort Belvoir, Va.	374	144 730
Army Medical Research Lab., Fort Knox, Ky.	361	144 714
Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.	357	144 713
	389	144 542

Source	Page	PB Number
Army Prosthetics Research Lab., Washington, D. C.	403	144 726
Army Signal Research and Development Lab., Fort Monmouth, N. J.	370	144 649
Arnold Engineering Development Center, Tullahoma, Tenn.	397	144 415
	412	144 585
ARO, Inc., Tullahoma, Tenn.	397	144 415
	412	144 585
Atomics International, Canoga Park , Calif.	425	137 811
Avco Corp., Wilmington, Mass.	424	144 438
Avco-Everett Research Lab., Mass.	362	144 345
	412	144 785
	432	144 736
Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.	359	144 717
Avion Div., ACF Industries, Inc., Alexandria, Va.	408	138 424
Ballistic Research Labs., Aberdeen Proving Ground, Md.	389	144 805
		144 809
		145 061
		145 063
	390	144 803
		144 808
	398	144 729
	405	145 060
	434	138 676
	437	145 062
Battelle Memorial Inst., Columbus, Ohio	375	137 806
		144 748
	396	161 323
	399	145 015
	401	145 032
	416	144 650
Bausch and Lomb Optical Co., Rochester, N. Y.	429	144 645
Bendix Aviation Corp., Southfield, Mich.	375	161 351
Bliley Electric Co., Erie, Pa.	375	137 422
Bolt, Beranek and Newman, Inc., Cambridge, Mass.	410	144 819
Brown U. Div. of Applied Mathematics, Providence, R. I.	410	137 930
		138 438
		144 823
	429	138 078
Brown U. Div. of Engineering, Providence, R. I.	410	138 909
	433	137 531
Bucknell U., Lewisburg, Pa.	354	161 339
Bureau of Yards and Docks, Washington, D. C.	374	144 513
	388	161 358
		161 359
	396	161 357
California Inst. of Tech., Pasadena	415	138 276
California U., Berkeley	405	144 546
		144 547
		144 552
	406	144 494
	412	144 553
	432	137 909
Carnegie Inst. of Tech., Pittsburgh, Pa.	390	144 831
Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsburgh, Pa.	438	138 505
Carter Observatory (New Zealand	353	138 236
Case Inst. of Tech., Cleveland, Ohio	375	144 582
	412	138 998
Catholic U. of America, Washington, D. C.	426	138 340
Chicago U., Ill.	405	138 576
		144 495
Clevite Research Center, Cleveland, Ohio	400	138 222
Climax Molybdenum Co. of Michigan, Detroit	399	144 447
Colorado U. Engineering Experiment Station, Boulder	376	138 571
Columbia U., New York	405	144 825
Columbia U. School of Engineering, New York	399	144 554
	434	144 420

Source	Page	PB Number
Compagnie Generale de Telegraphie sans Fil (France)	376	144 459
		144 597
Computation Lab., Harvard U., Cambridge, Mass.	376	144 973
	409	143 026
		144 590
		144 591
Cornell Aeronautical Lab., Inc., Buffalo, N. Y.	412	144 525
	413	144 652
	424	144 523
Cornell U., Ithaca, N. Y.	403	144 405
	432	137 936
Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.	413	138 687
		144 457
	415	144 456
Corning Glass Works, N. Y.	376	145 025
Courtney and Co., Philadelphia, Pa.	354	137 993
Crest Research Labs., Inc., Santa Fe Springs, Calif.	419	144 576
Crucible Steel Co. of America, Pittsburgh, Pa.	417	161 337
	420	161 338
Cruft Lab., Harvard U., Cambridge, Mass.	376	137 891
	382	144 518
	429	138 777
David Taylor Model Basin, Washington, D. C.	396	144 644
	409	138 431
	413	144 541
Dayton U., Ohio	359	161 333
Defense Atomic Support Agency, Washington, D. C.	374	144 501
Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio	371	161 177
		161 183
	399	161 188
	417	161 189
	418	151 076
		161 165
		161 180
		161 181
	419	161 184
		161 186
		161 190
	420	161 185
		161 187
deFlorez Co., Inc., Englewood Cliffs, N. J.	371	144 452
		144 453
		144 454
Department of the Army, Washington, D.C.	396	161 357
	400	144 930
Detroit Arsenal, Center Line, Mich.	398	144 760
	400	144 678
Deutsche Forschungsanstalt fur Segelflug (Germany)	366	144 240
Deutscher Wetterdienst, Aachen (West Germany)	366	137 823
Diamond Ordnance Fuze Lab., Washington, D. C.	353	161 320
	376	144 566
		144 705
	377	144 665
		144 710
	390	144 409
		144 704
		144 708
	398	144 664
	416	144 635
	425	144 565
	426	144 759
	429	144 755
Director of Defense Research and Engineering, Washington, D. C.	390	161 103
Du Pont de Nemours, E. I. and Co., Inc., Wilmington, Del.	417	144 564
Dynamic Properties Lab., Calif. Inst. of Tech., Pasadena	420	137 812
Eagle-Picher Research Labs., Miami, Okla.	362	161 353
Electrical Engineering Research Lab., U. of Illinois, Urbana	360	144 682
	377	138 574
		144 814
Electronic Communications, Inc., Timonium, Md.	377	144 598
Electronics Research Lab., U. of California, Berkeley	377	144 493
Engineering Materials Research Lab., Brown U., Providence, R. I.	420	137 865
Fabric Research Labs., Inc. Dedham, Mass.	402	138 405

Source	Page	PB Number
Fairchild Engine Div., Deer Park, N. Y.	432	144 449
Fansteel Metallurgical Corp., North Chicago, Ill.	400	138 315
	401	138 322
	437	138 323
Federal Telecommunication Labs., Nutley, N. J.	377	145 059
Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.	390	143 938
	391	144 743
		144 744
	401	138 354
		138 355
		138 356
	403	161 047
Ferranti Electric, Inc., New York	378	144 442
Flight Control Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio	372	144 530
Florida State U., Tallahassee	367	144 531
Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.	399	161 017
	420	144 570
Freeman, M. W., Co., Detroit, Mich.	417	145 029
Frick Chemical Lab., Princeton U., N. J.	362	144 143
Fuels Research Lab., Mass. Inst. of Tech., Cambridge	402	144 818
Fulmer Research Inst., Ltd. (Gt. Brit.)	429	143 118
General Electric Co., Schenectady, N. Y.	372	144 902
	391	144 609
		144 617
		144 618
		144 620
		144 627
		144 631
	392	144 353
		144 612
		144 613
		144 614
		144 621
		144 623
		144 626
	393	144 354
		144 355
		144 610
General Electric Co., Schenectady, N. Y. (con.)	393	144 615
		144 622
		144 628
	394	144 607
		144 611
		144 616
		144 619
		144 629
		144 630
		144 632
	395	144 608
	409	144 624
Geophysical Inst., U. of Alaska, College	354	137 890
George Washington U., Washington, D. C.	361	144 603
Georgia Inst. of Tech. Engineering Experiment Station, Atlanta	378	138 495
		138 496
		138 498
		138 707
Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.	429	138 445
Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena	398	137 529
	426	138 350
Harvard U., Cambridge, Mass.	405	137 863
		137 864
		137 872
	406	137 873
		137 926
		144 468
		144 489
		144 494
	425	138 447
	427	138 446
		144 458
Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.	430	144 578
Hearing and Communication Lab., Indiana U., Bloomington	357	137 944
Hebrew U. (Israel)	422	138 711
High Altitude Observatory, Boulder, Colo.	354	144 430
		144 455
	367	144 592
	395	137 796
Honeywell Research Center, Hopkins, Minn.	430	144 579

Source	Page	PB Number
Horizons, Inc., Cleveland, Ohio	363	138 422
Human Resources Research Office, George Washington U., Washington, D. C.	355	161 321
Hydrodynamics Lab., Calif. Inst. of Tech., Pasadena	416	145 035
Illinois State Water Survey, Urbana	367	144 670
Illinois U., Urbana	363	144 563
	397	161 325
	430	137 540
		144 568
Institute for Advanced Study, Princeton, N. J.	406	144 471
Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park	432	144 778
Institute of Aerophysics, U. of Toronoto (Canada)	413	144 739
		144 754
Institute of Engineering Research, U. of California, Berkeley	414	144 551
	416	138 110
Institute of Field Physics, U. of North Carolina, Chapel Hill	432	144 487
Institute of Mathematical Sciences, New York U., N.Y.	406	144 765
		144 766
	434	144 435
	435	144 427
		144 436
Institute of Optics, U. of Rochester, N. Y.	430	137 715
Institute of Personality Assessment and Research, U. of California, Berkeley	355	144 605
Institute of Research, Lehigh U., Bethlehem, Pa.	410	138 475
Instituto Nacional de Tecnica Aeronautica Esteban Terradas (Spain)	363	133 766
		143 172
		143 173
Ionospharen-Institut Breisach (Germany)	378	144 589
Ionosphere Research Lab., Pennsylvania State U., University Park	435	144 439
Ionosphere Research Lab., Pennsylvania State U., University Park (con.)	435	144 440
ITT Labs., Nutley, N. J.	378	137 694
James Forrestal Research Center, Princeton, N. J.	414	144 580
	419	138 612
	420	144 557
Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena	379	144 715
	414	144 716
Johns Hopkins U., Baltimore, Md.	364	137 994
	379	144 779
	433	144 732
Kaiser Aluminum and Chemical Co., Spokane, Wash.	416	144 646
Kettering Lab., U. of Cincinnati, Ohio	360	161 319
Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge	430	144 482
	437	144 654
Laval U., Canada	364	138 351
Lear, Inc., Grand Rapids, Mich.	372	144 543
Lockheed Aircraft Corp., Sunnyvale, Calif.	417	161 327
Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.	427	138 449
		138 450
Marathon Battery Co., Wausau, Wis.	379	145 503
Marine Lab., U. of Miami, Coral Gables, Fla.	369	144 746
Martin Co., Baltimore, Md.	418	144 522
Maryland U., College Park	354	144 416
	355	138 223
	365	138 539
	422	144 429
	424	137 942
Massachusetts Inst. of Tech., Cambridge	367	137 989
		144 798
	395	138 575
	401	144 559
	406	144 659
	427	144 229

Source	Page	PB Number
Massachusetts Mental Health Center, Boston	357	161 349
Material Lab., New York Naval Shipyard, Brooklyn	403	145 028
Material Labs., Puget Sound Naval shipyard, Bremerton, Wash.	404	144 699
		144 700
		144 701
Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio	372	111 648 (sup. 5)
Mauch Labs., Inc., Dayton, Ohio	379	144 749
Mellon Inst. of Industrial Research, U. of Pittsburgh, Pa.	379	144 545
Michigan U., Ann Arbor	407	144 772
	409	144 451
	411	137 839
	433	138 608
Michigan U. Research Inst., Ann Arbor	367	137 759
	379	138 790
		144 549
Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.	380	144 437
		144 822
	435	144 423
Midwest Research Inst., Kansas City, Mo.	372	161 317
Minerals Research Lab., U. of California, Berkeley	421	138 112
Minnesota U., Minneapolis	407	144 771
	411	161 348
Mississippi Southern Coll., Hattiesburg	357	161 316
Missouri U., Columbia	407	138 353
Motorola, Inc., Chicago, Ill.	380	144 914
National Bureau of Standards, Boulder, Colo.	435	151 384
	436	151 377
		151 382
		151 383
		151 385
		151 387
	437	151 394
National Bureau of Standards, Washington, D. C.	433	161 311
	436	151 368
National Research Lab., Ottawa (Canada)	364	144 509
	409	144 508
	414	144 507
Naval Avionics Facility, Indianapolis, Ind.	424	161 354
Naval Boiler and Turbine Lab., Philadelphia, Pa.	421	144 919
Naval Civil Engineering Lab., Port Hueneme, Calif.	400	161 326
Naval Engineering Experiment Station, Annapolis, Md.	421	144 651
Naval Ordnance Lab., Corona, Calif.	430	138 640
	437	144 479
		144 528
		144 558
Naval Ordnance Lab., White Oak, Md.	355	145 084
	395	145 030
	397	161 324
	411	144 720
	425	144 722
	431	145 027
Naval Ordnance Test Station, China Lake, Calif.	367	144 702
	380	144 721
	431	144 876
Naval Personnel Research Field Activity, San Diego, Calif.	355	144 537
Naval Personnel Research Field Activity, Washington, D. C.	355	144 536
	356	144 535
		144 538
Naval Radiological Defense Lab., San Francisco, Calif.	364	144 728
	396	144 801
	422	144 727
	423	145 026
Naval Research Lab., U. of Wisconsin, Madison	407	139 255
		144 550
	427	137 942
Naval Research Lab., Washington, D. C.	357	161 052
	364	161 067
	370	145 038

Source	Page	PB Number
Naval Research Lab., Washington, D.C.	370	151 805
	380	161 024
	381	143 407
		143 801
		143 803
		144 601
	395	143 406
	402	161 026
	425	142 854
	438	161 278
Naval Supersonic Lab., Mass. Inst ., of Tech., Cambridge	414	144 422
	415	145 023
	433	144 473
	434	144 496
Navy Electronics Lab., San Diego, Calif.	381	144 661
		144 662
		144 724
Navy Experimental Diving Unit, Naval Weapons Plant, Washington, D. C.	382	144 673
Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.	361	138 454
New York U. Coll. of Engineering, N. Y.	361	144 572
	372	137 797
	382	144 783
	419	144 561
	421	144 575
	422	144 492
North American Aviation, Inc., Columbus, Ohio	371	161 183
	373	137 866
Northwestern Technological Inst., Evanston, Ill.	421	137 847
Northwestern U., Evanston, Ill.	368	144 692
	369	144 693
Office of Scientific Research and Development. Div. 14.	382	144 648
Office of Scientific Research and Development. Div. 17.	382	144 518
Office of Technical Services, Washington, D. C.	403	161 332
Ohio State U., Research Foundation, Columbus	365	144 642
		144 643
	427	139 429
	437	144 681
Oklahoma U. Research Inst., Norman	373	1 1 347
Owens-Corning Fiberglass Corp., Newark, Ohio	402	144 574
Paris U., (France)	431	144 519
Patent Office, Washington, D. C.	353	144 504
		144 625
Pennsylvania State U., University Park	358	144 606
Pennsylvania State U. Mineral Industries Experiment Station, University Park	401	144 560
Pennsylvania U., Philadelphia	357	137 897
	369	138 077
	382	144 648
Perkin-Elmer Corp., Norwalk, Conn.	407	161 350
Philips Labs., Irvington-on-Hudson, N. Y.	426	144 521
Picatinny Arsenal, Dover, N.J.	395	138 508
		144 738
Pittsburgh U., Pa.	431	137 547
Plasma Propulsion Lab., Republic Aviation Corp., Farmingdale, N. Y.	433	144 490
		144 491
Plasmadyne Corp., Santa Ana, Calif.	365	144 768
	434	144 488
Polytechnic Inst. of Brooklyn, N. Y.	411	161 318
	415	144 903
		145 033
Potter Instrument Co., Inc., Plainview, N. J.	358	144 424
Powder Metallurgy Lab., Stevens Inst. of Tech., Hoboken, N. J.	417	145 029
Princeton U., N. J.	357	137 897
	373	144 815
		144 816
	399	144 577
Propulsion Research Lab., Polytechnic Inst. of Brooklyn, N. Y.	398	144 500
Psycho-Acoustic Lab., Harvard U., Cambridge, Mass.	425	144 685

Source	Page	PB Number
Purdue U., Lafayette, Ind.	365	144 741
	407	144 753
	423	137 844
Quartermaster Research and Engineering Center, Natick, Mass.	366	144 450
	402	144 532
	424	144 534
Radio Condenser Co., Camden, N. J.	382	144 872
		144 873
		144 954
	383	144 874
		144 875
Radio Corp. of America, Princeton, N. J.	383	137 828
Raytheon Mfg. Co., Newton, Mass.	383	138 052
		138 054
		138 055
		138 094
	384	138 051
Rensselaer Polytechnic Inst., Troy, N. Y.	421	144 529
Research Center for Human Relations, New York U., N. Y.	358	144 604
Rice Inst., Houston, Tex.	431	137 846
Rochester U., New York	362	138 347
Rock Island Arsenal Lab., Ill.	404	138 408
		138 409
	421	161 352
Rodman Lab., Watertown nal, Mass.	397	138 506
Rome Air Development Center, Griffiss AFB, N. Y.	384	144 775
	407	144 485
	438	144 407
Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis	373	145 031
Royal Inst. of Tech., Sweden	411	161 356
Rutgers State U., New Brunswick, N. J.	397	144 540
St. Anthony Falls Hydraulic Lab., U. of Minnesota, Minneapolis	416	138 550
Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh, Pa.	423	138 573
School of Aviation Medicine, Brooks AFB, Tex.	360	144 687
Seattle U., Wash.	384	144 657
Semiconductor Lab., Hughes Products, Los Angeles, Calif.	384	138 484
Servomechanisms Lab., Mass. Inst. of Tech., Cambridge	373	144 640
Springfield Armory, Mass.	421	144 567
Stanford Electronics Labs., Stanford U., Calif.	384	137 914
		138 549
		138 585
Stanford Research Inst. Menlo Park, Calif.	384	145 045
	385	145 046
		145 047
		145 048
		145 049
	386	145 050
		145 051
		145 052
	387	145 053
		145 054
		145 055
		145 056
		145 057
	395	145 595
Stanford U., Calif.	438	144 672
Statistical Techniques Research Group, Princeton, N. J.	407	144 817
Stavid Engineering, Inc., Plainfield, N. J.	410	144 425
Stockholm U. (Sweden)	431	144 408
Sundstrand Turbo Div., Sundstrand Machine Tool Co., Pacoima, Calif.	398	144 656
Swarthmore Coll., Pa.	397	161 322
Sylvania Research Labs., Bayside, N. Y.	387	138 590
	419	144 972
Syracuse U., N. Y.	360	144 686
	428	137 886
	433	137 922
Syracuse U., Research Inst., N. Y.	387	137 852
	427	144 458
Teachers Coll., Columbia U., New York	356	144 788

Source	Page	PB Number
Technisch Documentatie Centrum voor de Krijgsmacht (Netherlands)	432	144 826
Texas A. and M. Coll., College Station	368	138 225
Titanium Metallurgical Lab., Battelle Memorial Inst., Columbus, Ohio	417	144 564
Transistor Applications, Inc., Boston, Mass.	388	144 426
University of Southern California, Los Angeles	365	137 534
University of Southern California Engineering Center, Los Angeles	414	144 781
Upper Air Lab., U. of Colorado do, Boulder	429	144 434
Uppsala U. (Sweden)	423	138 491
Utah U., Salt Lake City	396	138 177
	417	144 562
Vermont U., Burlington	358	137 884
Virginia Agricultural Experiment Station, Blackburg	408	144 400
Virginia U., Charlottesville	359	144 586
	361	144 603
Washington U., St. Louis, Mo.	408	138 577
Watertown Arsenal Labs., Mass.	396	161 328
Wayne State U., Detroit, Mich.	400	145 034
	408	144 401
Weather Forecasting Research Center, U. of Chicago, Ill.	368	144 689
Westinghouse Research Labs., Pittsburgh, Pa.	374	142 947
Wiilow Run Labs., U. of Michigan, Ann Arbor	358	144 548
	425	161 329
		161 330
	426	144 502
Wisconsin U., Madison	361	161 315
	368	144 428
	408	144 433
Yale U., New Haven, Conn.	422	138 079
		138 253